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Essentials of Organization and Management

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SYNOPSIS—The methods and objects of mine management are so often misunderstood that a broad discussion is necessary. Mining is a business having clearly defined objects, among the most important of which are securing greatest ultimate profit and providing greatest present value of the property. Costs are interesting only in their relation to the whole; not as independent items.

I should like to put this discussion on broad grounds. Technical men are sometimes led into the superficial view that organization means only a list of positions to be filled; others sometimes have the idea that success in mining is not due to good management but to luck. That luck does play a good part in distributing the prizes of the mining business is undeniable, but it should be plain that it has no more to do with the proper administration of a mine than with the proper administration of anything else.

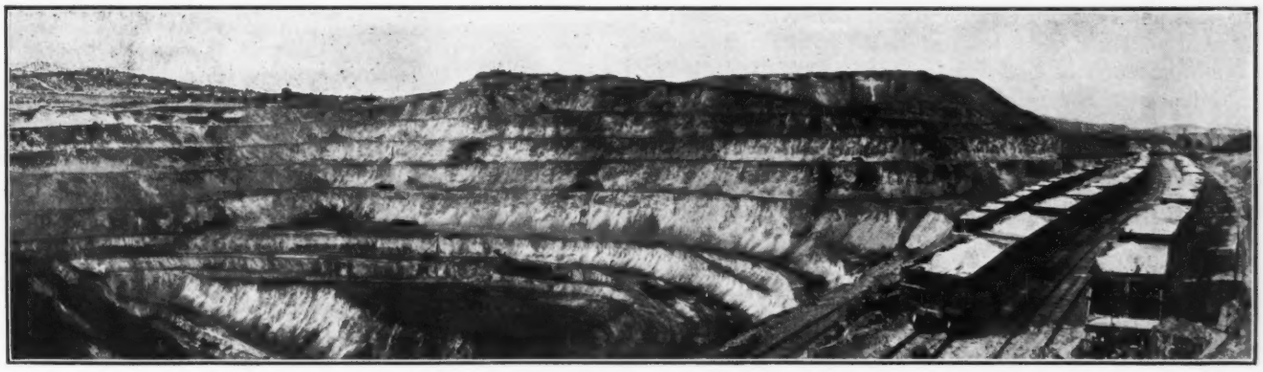
Efficiency Is Independent of Personalities

The question of efficiency in operating is quite distinct from the question of who is to be benefitted by that efficiency. We must begin by making it plain that the efficient management of a property as understood in this article relates only to getting out and disposing of the products with as little effort as possible. The emoluments that come from doing this may be so distributed as to leave many of the persons interested highly discontended, feeling that somebody is getting too much or too little of the proceeds of the industry, even though the work itself may be going on in the best possible manner. On the other hand, some individual may make a great personal gain out of a badly managed business.

Industrial efficiency means securing the maximum result from each effort and the elimination of unnecessary effort. Further, it means hitting the mark—making the organization do what it is designed to do—no more, because that costs too much; no less, because that would be a failure.

The mark to be hit by the business organization is profit. In a technical sense it is easy to conceive of an organization being highly developed to do something for which there is no commercial demand. I suppose mere scientific effort, however well directed—as, for instance, the effort of an astronomical observatory to find new stars—can hardly be called business. A mine is a purely business concern carried on with the sole object of making money. The best management—good morals and fair dealing being taken for granted—is the one that will make the most money for the stockholders.

The fire of efficiency is fanned by competition, but the management of many mining concerns is protected from competition by the nature of the enterprise. The deposit may be rich enough to pay whether it is properly worked or not, and when the profits are good the management is usually conceded to be good. This is a handicap to the managers of such properties. The proof of this is that the leading spirits of great mining concerns have usually been trained not in the management of rich mines but in the highly competitive smelting or manufacturing fields connected with mining.



PART OF EUREKA PIT OF NEVADA CONSOLIDATED COPPER CO., ELY, NEV.

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The mining business comprises the following elements:

1. The determination of how big a field there is for the enterprise. This means usually how much ore can be counted on and how long it will take to get it out advantageously and market it.
2. How to do this work.
3. How to finance and promote the work.

These elements could be elaborated into an infinity of detail, but for the present purposes it seems best to state them this way merely to define the broad requirements which underlie the organization of mining enterprises. With this object in view let us dwell a little upon these elements.

The determination of the scope of an enterprise proceeds from information. This information comes broadly into three groups—(1) the local facts about the occurrence and development of the ore, the area of property available, the climate, facilities for transportation, labor, supplies, politics, etc.; (2) the geological situation; (3) the commercial situation—that is, knowledge of markets for the products to be dealt with.

Part of this information can and should be exact, namely, the first group. The second and third groups of information yield conclusions in the form of intelligent guesses or approximations. No one should conclude that because geological and commercial conclusions have an element of guesswork that they are therefore unimportant. Quite the contrary. For the very reason that it is impossible to see accurately through the ground or into the future it is all the more important to draw sane inferences from ascertained geological facts and from the facts of the commercial past. Just as the statesman and lawgiver would be a dangerous man if he did not know the history of nations and laws; just as the doctor would be a quack if he did not know the history of cases; so the promoter of a mining enterprise is a dangerous man if he is not acquainted with the history of mines.

It is very seldom indeed that the true measure of a mine's possibilities can be taken from the ore actually developed at the time the enterprise is launched. The development work generally keeps ahead of the extraction of ore only by a little more than the necessary margin of preparation. This fact is less sweepingly true now than it was a decade ago, and less true of low-grade deposits than of richer ones, for great progress has been made in testing mineralized areas and also in using good geology as an aid in the work of exploration. But it is unquestionable that the exploration of deposits to insure supplies of ore is in itself an important part of the conduct of the enterprise, and the wisdom of such exploration must be based upon geological inference.

Details of Operation and Finance

The actual work of mining involves all sorts of engineering—civil, mechanical, electrical, chemical, and metallurgical; the employment and discipline of labor; sanitation; transportation and the keeping of records. But the scale on which all this is to be done and the steps to be taken must be based upon the interpretation of the information already referred to. This is just as true whether the enterprise grows insensibly from a small beginning or whether it is launched suddenly as a great enterprise.

It is essential that the finances be accurately coördinated with the scale of operations. Too much money employed as capital means wasted power, the unnecessary use of resources. Too little capital means deficient operating power and may cause great losses through sheer failure to accomplish the required result. For instance, a capital limited to $1,000,000 used to start the Utah Copper Co. would have been all wasted, because the amount required to make that vast low-grade deposit pay was at least $5,000,000.

As in the case of operating, already discussed, it makes no difference in the importance of finance whether a concern grows gradually or suddenly, or whether it is owned by an individual or by a corporation, or whether it is large or small. Business involves the use of money whether that money is diverted from earnings, whether it is borrowed, or whether it is obtained from popular subscription. The financial guidance of an enterprise is just as important as its technical guidance; in fact, it underlies and empowers the technical guidance.

Futility of Unbalanced Efficiency

I have discussed the fundamental and more or less self-evident factors in order to illustrate what fields of accomplishment and training must be covered by the personnel of a mine organization, and also, if possible, to prevent persons interested in one department of the business getting a wrong idea of the importance of the other departments of it. I feel that it is so important to get these things right that it is worth while to risk repetition in laying stress on the axioms that knowledge of the physical characteristics of mines and markets will fail to reach its maximum usefulness unless it is backed up by the proper technical and operating equipment and efficiency; that, on the other hand, the technical scheme, however capable in itself, cannot deliver the proper results unless it is gaged to meet the true capabilities of the mine and its markets; and further, that commercial efficiency is out of the question unless the scheme is in tune with good finance.

The first requirement of a mine organization is that these facts shall be recognized by the owners. The basic element of efficient management therefore is efficient ownership. A substitute for ownership may be an efficient control of the stock. But after all, what security is there that the control of a corporation will stay in good hands unless the stockholders know how to see that it does?

I am inclined to think that the importance of good ownership is often overlooked by technical men and employees. It certainly is wasted effort to repair the superstructure when the foundation has given way. The secret of many a good enterprise going to seed lies in the deterioration of ownership. This is a fact that is thoroughly recognized by successful business men, whose first inquiry about an enterprise is not, "What is the property?" but, "Who are the people?"

It is of course out of the question to expect that every stockholder of a large corporation will be a good mining man, or even a good business man; but the average stockholder must know enough to put in control of the stock and of the board of directors a man, or group of men, who have the following qualifications: Honesty; sense to recognize good information about mines; good financial judgment; sense to recognize good technical, executive and commercial ability.

Assuming that an enterprise is conducted by a corporation, the cornerstone of actual management is a board of directors. While in the long run most of the work of a board is in a sense perfunctory, being habitually the indorsement of its officers, there can be no assurance whatever of good management unless it possesses the four qualifications just mentioned. A good board will probably depend on certain members to guide its judgment in certain special fields. The directors in general must be good business men; some members should be trained mining men, some trained technical men, and some trained financiers. This is the makeup of most of the boards of efficient and successful mining corporations. The more aggressive and successful a mining company is, the more decidedly has its board this kind of membership.

The idea that directors should be figureheads, if necessary, so long as they represent a certain amount of stock, generally means decadent management. A director is not necessarily a rich man. In strong concerns they are quite often distinguished employees, who contribute practical contact with the business and the interest that comes from the necessity of accomplishment. The idea that directorships should be mainly well-known names borrowed from famous financial institutions or be of social or official prominence arises generally from some need for advertisement, a need that should create suspicion.

The chief responsibility actually administered by the directors is that of finance. To them belongs the function of declaring dividends, or of authorizing loans. In this relation the importance of having a board which contains enough "mining men" to be fully alive to the peculiarities of mining is emphasized. The board must be able to understand the importance of changes shown in the development of the mines, to appreciate the need of caution when the signs point toward exhaustion, to gage the opportunities arising from favorable developments, to meet the requirements resulting from changes in the conditions of the mines, in the character of the ores and in metallurgical practice.

Duties of a President

I have been discussing the qualifications of the owners and their representatives in groups. The stockholders of mining concerns are usually many hundreds, sometimes many thousands, in number. The directors usually number from five to twenty-five. From now on I will consider individuals. Of these the most important is the president, who is the executive officer of the board. He is the central figure of the whole organization and represents both owners and employees. On the one hand, it is the president's business to exert upon the employees the authority and purposes of the owners; on the other hand, being generally an employee himself, he is bound to have to some extent the employees' point of view.

It is clear that the president's main function is to deal with people. In the case of large concerns where he must deal with thousands of stockholders and employees the job requires a decided faculty of leadership, which means insight into human nature, poise, calmness, energy and definite purpose. Technical qualifications fall into the background. Mining on a large scale approaches very closely other forms of business. The president of a large railroad system does not have to go into technical questions, but merely to deal with men who do. He forms his judgment not so much on what he knows of railroading as what he knows about men. A man who makes a success of railroading in this way could almost certainly run an equally large mining business acceptably.

The president's contact with the technical work increases as the scale of the business diminishes. In a small mine this office may become merely nominal. The president of a mining company employing only 50 men might very properly spend part of his time working underground as a miner. The division of labor is in proportion to the number employed in a given organization, and as this number diminishes, more and more functions are merged in the individual. This applies to workmen as well as officers. Just as the president of a small mining company may have to be financier, bookkeeper, manager, superintendent and foreman of his company, so the miner, who never sees the blacksmith-shop of a large property, may have to sharpen his drills as well as use them when he works in a small mine.

To create the greatest possible present value is the proper object of conducting the business. This is a point of view not easy to grasp fully or to reach, or adhere to. An abnormal exibition of low costs and large profits may be, and often is, made simply by suspending temporarily expenditures which must go on. It is also possible to take out, for a limited period, richer ore and more ore than a mine can average. So long as temporary profits are made abnormal only in the effort to obtain profits quickly, a proper object is gained by giving the stockholders the use of their profits sooner. But these temporary showings are often injurious to the property in both a physical and economic sense. Premature extraction of ores without adequate development is highly injurious by creating unnecessary dangers to men and losses of ore. Such premature mining often shows profits in such a manner as to produce a false impression of value.

Field of Technical Management

The responsibility for adhering to a broad scheme for obtaining the best results lies not with the technical management but with the president.

Among mining enterprises there is a great diversity of opinion as to what constitutes the main problem. Sometimes it is the maintenance of the ore supply by constant exploration; sometimes it is merely to secure low costs in the handling of large tonnages already assured; sometimes it is a struggle with metallurgical difficulties. But one general fact underlies practically all operations, namely, that results are obtained not through muscular activities of men, but by the intelligent use of mechanical units which men direct and of which men are parts. A certain bodily activity is of course necessary to manipulate properly the machines. While some work like shoveling is still propelled by men's muscles, the average man about a mining plant manipulates perhaps 10 hp. The proportion of mechanical as against human power is therefore several hundred to one, and the value of intelligent manipulation needs no further demonstration.

The responsibility for securing this intelligent manipulation lies with the manager. His aim is to produce the most profitable effect from his whole mechanical equipment; therefore he must see to it that each unit composing that equipment does its duty. To perform this

duty properly each unit must be worked as near to full capacity as possible; for otherwise men and power will be kept busy without adequate result.

To accomplish this in mining requires energetic exercise of the sense of proportion, of constructive imagination, and of executive ability. The work in a mine is constantly shifting. A group of men and machines may be well occupied today in a certain stope, but tonight some change may develop which will permit only half the force to be occupied profitably there to-morrow. An exploring drift reaches its objective and that particular piece of work must be stopped; the time arrives when hand tramming is no longer either adequate or economical and mechanical tramming equipment must be installed; or, on the other hand, the supply of ore from a certain shaft has so fallen off that more equipment is in use than is justified by the output.

In any property of considerable size it is impossible for the manager to get into personal contact with all these details. It is necessary therefore to supplement his own activities with an organization so arranged as to keep him informed. Various organizers will call these departments by different names and approach their problems from different angles, but, broadly speaking, we may classify the manager's working force into two divisions:

1. The division of information, which will contain the map-makers, engineers and geologists, the samplers and assayers and the cost and record-keepers. This work is not inherently valuable; it is merely a means to an end. The manager must not make it the field of his own labors; its purpose is to add to his capacity to direct the productive work. It is of course important that this division should not be overdone.

2. The division of executives covering construction engineers and all the operating force.

Proper Supervision of Labor

The limits of this article will not permit much discussion of the various reports dealing with the supervision of labor; but I can briefly point out some of the essentials that must be covered. It is possible to gather the data collected by the division of information into a daily summary which will be at least approximately correct. This will show the following supremely important items:

1. The number of men employed and their distribution in whatever detail is desired.

2. The amount of product obtained from this labor, the quality of this product and the disposal of it.

These facts are decisive as to the efficiency of the job. The expenses of a company are invariably in proportion tc the number of men employed. For instance, if at a given mine you employ 10,000 shifts of labor in a given month, and you find that your total expenses were $50,000, it is a mathematical certainty that next month when you employ 12,000 shifts your expenses will be $60,000. In other words, the expense involved in employing a man on the property in question is $5 per day. This figure once established you have a short cut to your total expenditures which can be applied at any moment.[1]

[1]The cost per man referred to is not merely wages; it is the total expense of wages, supplies, power and administrative effort required by the labor. These items vary within such narrow limits that it is hardly inaccurate to speak of them as constant. In a given property these relations can only be disturbed by a radical change in the scale or method of operating such as are not contemplated in these remarks.

The degree to which the manager can digest the details of labor will vary according to the size of the property, or in proportion to the number of superintendents he employs. On a small property the manager is his own superintendent, but on a large one he will have to restrict his observations to larger units, delegating the daily supervision to superintendents of particular fields. Each superintendent must watch his field of operations exactly as a manager does, the only difference being that instead of covering the whole property he only covers a part of it; that he deals with smaller units and has a more intimate contact with the men and products of his special field.

Constant Supervision of Products

Just as a proper record of the employment of labor gives a clear idea of daily expenses, a similar record of the product obtained gives an immediate line on the daily income. One is just as important as the other, but the supervision of product is more difficult and less exact. It involves correct weighing, sampling and assaying—three steps, each apparently simple but really very difficult. While the labor record involves no equipment except paper and pencil, it is not too much to say that the basis for proper accounting of the product lies deep in the design of the plant and the training of the whole technical organization. Proof of this is the care with which these subjects are elaborated in technical mining literature. I limit my observations simply to pointing out where they belong in the business scheme. A realization of the true importance of the supervision of products is the prime technical qualification of a mine manager. Without it he can have no effective engineering point of view and will have to depend on guesswork and rule of thumb.

To get maximum profits it is necessary to work out the following points: What volume and grade of ore extracted daily will cover the total expenses of the company? What grade will cover the cost of mining and smelting, but not necessarily the general and outside expenses? What ores, too low in grade to be a true object of mining, may yet profitably be treated if obtained in the process of development? Which ores should be sent directly to the smelter and which should be concentrated or otherwise treated at the mine or mill? What are the metallurgical losses of all processes, and the extent to which they may be curtailed profitably?

By balancing these factors against one another and against the cost of constructing and operating the necessary plants, the manager finally works out the number of steps of his process and the logical and most economic cost. This cost will naturally be as low as possible in proportion to the money received for the product sold; but a little reflection will show that this is not necessarily the lowest cost per ton of material handled in any department.

This problem is present at all mines. The coal or iron miner who deals with a homogeneous material may find it much easier to solve than the miner of complex ores of precious metals; but it is there just the same, and the intelligent manager will always recognize it.

It is a frequent mistake to suppose that the important facts are revealed by the cost-keeping or accounting system. This is emphatically not the case. A thorough accounting of a month's operations cannot be prepared

before the middle of the following month. This means that the acts of which it is a record are from two weeks to seven weeks old before the record appears. If a manager waited that long before taking action on the changes which develop from day to day he would make himself ridiculous. It is infinitely more to the point to have daily facts presented in usable form, even though some of the information is only approximate.

A discussion of accounting may conveniently follow the preceding remarks because it is important to combat a frequent misunderstanding of its true value. Accounting is not management. Broadly speaking, it is not a function of the technical management at all, but is a function of the board of directors, which should be administered by the financial officer of that body—the treasurer—who is frequently also the recording officer, the secretary. These officers are subordinate to the president, but they are quite distinct from the technical manager, who deals with only a portion of the business. It is the duty of these officers to account to the stockholders and creditors of the concern for the income and outgo of funds and properties. But we should bear in mind a broad distinction between company accounting, which is the business of the treasurer for the benefit of the stockholders and creditors, and department accounting, or cost-keeping, which is essentially a record of efficiency for the benefit of the work itself.

In either department the usefulness of the accounting depends entirely upon how effectively it presents the vital facts. Elaboration of detail where not needed is mere pedantry, which instead of serving the true purpose of accounting helps to defeat it. Simplicity and brevity of statement should be the aim. The figures of a cost statement may be likened to the topography of the country. When you find a vantage point you can see the lay of the land. A man in the cañons at the foot of Pike's Peak might lose himself looking for the summit, but if he walks out on the plain he can see it easily. Likewise in business, the man who wants to know where he is going refuses to bury himself in a maze of figures. He tries to keep before himself the general outline of his problem in order that when he plunges into detail he may still not forget the relative size of things.

Unit Costs as Operation Guides

In the general accounting of a company's business all figures are stated necessarily in money. But in cost-keeping or department accounting an eye should be kept not only on money values but also upon the things which the money represents. The work is done by labor aided by mechanical power, by explosives, by timber, tools and other supplies. The efficiency of the job is exhibited even more decisively when shown in terms of these elements than when shown in dollars and cents. For instance, Nevada Consolidated Copper Co. reports that the average amount loaded per steam-shovel shift is 1472 tons, but that the maximum loaded was 6784 tons. The average time each shovel was actually at work was only 30% of the working day. It is plain that their operation is frequently interrupted and that efficient operation has much to do with minimizing those interruptions. The manager may have found that the cost of increasing the working time of the steam shovel would be too great to justify it. While he might increase the output per steam shovel, he might decrease the output per man. He would then lose money. But if he can increase his output per shovel by increasing his concurrent cost in less proportion, he will gain. We have thus reasoned back to the conclusion that the work of the steam shovel is not the decisive criterion of efficiency, unless we include with it everything needed to make its work complete.

Lowest Costs Per Man Not Always Best

To illustrate this let us take the whole situation just outlined. Nevada Consolidated employs 611 men all told and eight steam shovels working two shifts each. The number of men actually attached to each shovel is only about 17 for both shifts, and it burns 5.7 tons coal per day. With labor at $4 per day and coal at $5 per ton the cost of the steam shovel is about $100 per day, and its output is 2942 tons for the two shifts. But the total number of men employed is 611 and the cost is, say $3055, or $5 per man. Eight steam shovels are employed, the total output being 23,852 tons. Suppose we employ another steam shovel and get half as much from it as we get from the others. We have increased our cost by $100 a day and our tonnage by 1472. The total number of men is now 628 and the total cost $3155. The cost per man is now $5.02 per day, which is very close to what it was before. But the output has risen from 23,852 tons to 25,324 tons. Per man it has risen from 39.04 to 40.32. The difference does not appear to be great in either cost or output, but proportionately it is, for with an increase in cost per man less than 0.5%, the output per man has increased over 3%. Thus the increase of output is about seven times the increase of cost. Let it be remembered that in doing this we are decreasing the averaging efficiency of the steam shovels. This indicates that the cost per man is much more stable than the cost per shovel.

Now, applying this discussion to the cost-keeping problem, we come straight back to the vital importance of making the statements indicate the decisive facts which prove efficiency. What these facts are needs to be worked out for each property. I have found it beyond my powers to make a general statement that will apply everywhere. While it is true that the output per man is a most important figure, it is equally true that it must be applied only when modifying factors are clearly understood, and then only to the proper units. It has been shown that a mistake would have been made in assuming that a steam shovel taken by itself must be run at full capacity, regardless of other things. The fact is, however, that instead of bringing in the full normal equipment that goes with a steam shovel we only brought in a part of it. The eight shovels employed 611 men, or 76 each; but with nine shovels we only had 628 men, or 70 each. The point brought out was that the machine itself is relatively unimportant so long as it does not alter the normal scheme of things. In keeping the cost of operating that shovel it would be a great mistake to rivet attention on the engineers, cranemen, and firemen, and the amount of coal it burns and the supplies it uses. The real unit is the shovel combined with the locomotives, tracks, cars, railroad and dumping facilities. The force required to operate such a unit night and day is generally 75 to 100 men, and not the 15 or 20 men working on or about the shovel. When this fact is got straight the true unit cost is made effective.

It is an axiom that each operating unit should be worked as nearly as possible to its full capacity. The converse is that where the output is limited at some point—as, for instance, by the capacity of a mill—the units required to supply that output should be cut down to the smallest possible number. A shaft is such a unit. The cost of a shaft and the maintenance of its hoisting, hauling, pumping, lighting and compressed-air equipment, its railroad trackage, shaft houses and shipping equipment mean a large amount of fixed expense. Whenever it is found that a number of such shafts can produce more than the required output, economy demands that some of them should be ruthlessly shut down in spite of the apparent waste. The truth in such a situation is that capital has been wasted in providing unnecessary equipment, but that is no excuse for wasting still more money to operate it. How often situations of this kind arise it is hard to say. One example is found in some mines in Southeast Missouri, where a few years ago 24 shafts were used to supply 2,300,000 tons a year. Now eleven of the same shafts supply 3,200,000 tons a year. Thirteen shafts with abundant ore reserves are rotting and rusting at a saving of possibly $1,000,000 a year.

Estimation of Major and Minor Units

In the whole process of organization there are controlling limitations. The company itself is limited in its activities by its capital and its opportunities. Its properties are each limited in some way—the output of a mine by either its own capacity to produce or by the capacity of a mill or smelter or market. These limitations are extremely important in calculating the size and number of concomitant units. Minor units make up major ones, and the effectiveness of each within its sphere becomes highly important once that sphere is established. There is a certain subtlety about these distinctions that is worth dwelling upon.

The cost of power, for instance, is an important thing in a mining property, but its unit cost is capable of being misapplied. The power plant properly should deliver the minimum output required for the work. The proper aim is not cheap horsepower but cheap work. In one case a plant was supplying compressed air and electric power at a cost of 1c. per kw.-hr., while its neighbors were making power at 1.25c. per kw-hr. But at this plant the cost of power per ton of ore was 45c. and at its neighbors' only 25c. The superintendent was astounded when brought to task for his high power costs, pointing to his low cost per hour. The fact was that the power was being wasted. Efficiency at the engines did not excuse leaky pipes, scattered and inefficient pumps, and machinery used where it was not needed. Accounting, with the emphasis on the wrong point, was exhibiting a false economy, which was costing the company in reality $80,000 a year.

But the mere fact that the kilowatt-hour is a minor unit does not destroy its importance. It is important to make cheap power, but the supply must be limited to the requirement. Any additional power made is a waste, no matter how cheap it is.

It would be a false economy, likewise, in order to show a low consumption of drill supplies, to let them run in bad repair, or, in order to show a low consumption of compressed air per drill, to use more machines than necessary and let them stand idle part of the time. The true result to be reached is cheap ore breaking and not cheap supplies or cheap air per drill. That fact, however, does not in the least argue against economy in both these items—economy rightly applied to its proper unit.

Big Things vs. Little Things

The argument leads to one principle that should underlie effective organization, namely, that big objects take precedence over little ones. It is a theory with some people that if you "take care of little things the big things will take care of themselves." This is like starting in to make an automobile by first making the screws and bolts. It is an utterly illogical and ineffective theory. The first essential of an automobile is a design—some plan by which a vehicle can be made to serve a certain purpose, have a certain appearance and attain certain speed. This design involves the use of definite mechanical principles which must be satisfied by the creation of essential mechanical entities—the motor, running gears, wheelbase, etc. The mass of detail work which follows must be adapted to the essential scheme and grow out of satisfying the needs of that scheme. Success depends on the nicety and intelligence with which the details are worked out. A lot of work can be put on the paint, but the paint is not wholly essential. It is well to remember that the car will go just as fast and ride just as easily whether the paint is black or white. But when the car is sold the color of the paint may decide the buyer for or against the whole car, and may therefore determine its commercial success or failure. Some people will argue that this proves the vital importance of this small detail. But the manufacturer is entitled to answer: "Our design is to create a car that will sell; we are merchants as well as engineers. To please our customers is a prime essential; the color of the paint is a trivialty. Our customers cannot decide fundamentals of construction, but on this point their judgment is controlling. By our theory of doing business we are bound to accept their decision."

Thus the question is decided not in the least by virtue of minute detail in itself but by the application of a cardinal principle. The true organizer will neither disparage nor overlook details, but he will be their master and not their slave. He will not love them for their own sake, but will use them to further his plans.

North Carolina Metal Output

North Carolina easily retained first rank in gold output among the Eastern or Appalachian States in 1914, the yield having been the second largest in the last 10 years. The total production of gold in 1914 amounted to 6343.94 fine ounces, according to the Geological Survey, the value of which was $131,141.

The gold was obtained from 12 placers and 9 deep mines, but several of the mines made a very small production. The largest producing placer was the Biggerstaff, in Rutherford County. The Iola mine, in Montgomery County, had the largest yield of gold from deep mining. Other mines which contributed an appreciable part of the gold output were the Rich Cog and Uwarra mines, in Montgomery County; the Gold Hill, in Rowan County; and the Howie, in Union County.

The silver output of North Carolina, recovered as a by-product from gold milling, was 1524 fine ounces, valued at $843, against 1812 fine ounces, valued at $1095 in 1913. The copper production in 1914 was 20,434 lb., valued at $2718.

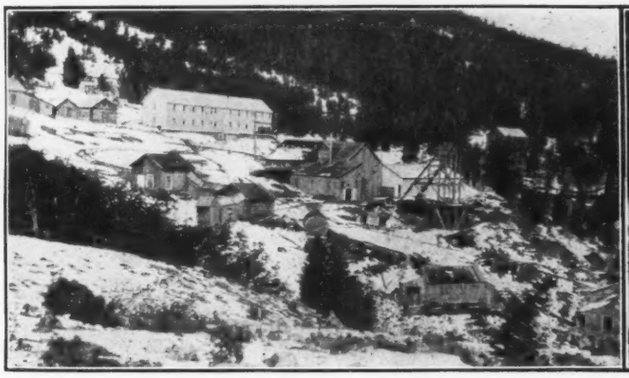
Piegan-Gloster Cyanide Mill

By Alexander McLaren*

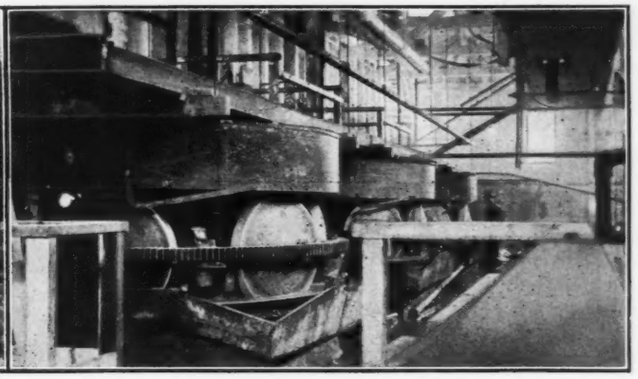
The Piegan-Gloster, of Marysville, Mont., is one of the many gold properties characteristic of those old mining camps which, after years of idleness, are once more experiencing activity because of the more economical and efficient methods of mining, milling and cyanidation of the present day. This property is situated about three miles from Marysville, Mont., and is owned by the Barnes King Development Co. The ore is delivered to the mill from the mine over 1400 ft. of Riblet two-bucket aërial tramway, dumping into a receiving bin on the same level as the mill bins. From this the ore is fed to a No. 5, T. L. Smith short-head (gyratory) primary crusher by a belt conveyor. This crusher breaks from mine-run down to approximately 1¼-in. ring and the ore is then elevated by a continuous-bucket elevator to an automatic sampler at the bin head, then by a distributing belt conveyor to the main or mill bin.

From the mill bin the ore is fed to three Lane slow-speed chilean mills by Stephens-Adamson automatic belt feeders. The mills are 10 ft. in diameter and each one from which the thickened pulp is transferred by diaphragm pump to one of a series of Dorr agitators 16 ft. diameter by 14 ft. deep. These agitators are not connected in series, the charge method being used. Overflow solution, prior to going to zinc boxes, is filtered in two small tanks through a layer of sand. Zinc shavings are used as precipitant.

One 40-hp. motor drives three Lane mills, two concentrators, one Akins classifier and the pulp distributor for the leaching tanks. In this mill, after considerable experiment on the part of the management, the slow-speed chilean mill has been found far superior to the stamps formerly used. The advantages are less wear and tear; less power consumed per ton of output; a pulp better adapted to cyanidation and water consumption nearly 80% less than that required by stamps for crushing. Less operating vigilance is required.



PIEGAN-GLOSTER PLANT, MARYSVILLE, MONT.



CRUSHING INSTALLATION OF LANE MILLS

handles approximately 50 tons of ore per 24 hr., performing the crushing in cyanide solution. It may be said that the ore is slightly harder than the average quartz. A 6-in. overflow discharge is used with a strip of ordinary fly screen to withhold the chips and prevent clogging the pulp pipes. The consistency of the pulp is 4½ parts of solution to 1 of solids. The combined output of the three Lane mills is carried by launder to a Wilfley roughing table, the concentrated output of which drops to a Wilfley finishing table. The product is a black sand with some coarse gold, and is treated by amalgamation in a cleanup pan. The overflow from both the roughing and finishing table goes to an Akins classifier for further separation.

The sands proceed to one of a series of leaching tanks, 10 ft. staves and 26 ft. in diameter, the unloading of which, after treatment, is performed by flushing. The slimes are taken to a 24-ft. Dorr thickener, 7 ft. deep,

*Litchfield, Conn.

Rescinding Purchases of Mining Property

By A. L. H. Street*

Under a decision of the Kansas City Court of Appeals, a purchaser of mining property cannot rescind the transaction on account of misrepresentations made by the seller to the purchaser's agent concerning the character of the property, if the agent was not deceived by such misreprensentations or did not rely upon them. The court says: "Applying the rule that an attempt fraudulently to deceive must be so far successful as to have induced belief and reliance on the part of the person claiming to have been injured, we find that plaintiff's case failed."

It is further held, in the same opinion, that one induced by fraud to enter into such a contract must promptly elect to rescind on discovering the fraud, or his right to cancel the purchase will be deemed to have been waived. (Greenstreet vs. Walsch, 176 Southwestern Reporter, 1062.)

Exposition of American Chemical Industries—The first American exposition of chemical industries will be held at Grand Central Palace, New York City, during the week beginning Sept. 20, 1915. It is to be managed by C. F. Roth and A. Nagelvoort, assisted by an advisory committee of nine eminent chemical engineers. It is expected to include coal, wood and petroleum products, metals, minerals, water and sewage purification, air and gas processes, glass and ceramics, oils, varnishes, plastics, rubber, leather, glue, etc. Working exhibits will be shown. Inquiries should be directed to the National Exposition of Chemical Industries, 46th St. and Lexington Ave., New York City.

*Attorney, St. Paul, Minn.

Orebodies of the Mesabi Range--III

By J. F. Wolff*

SYNOPSIS—Methods of exploring Mesabi orebodies. Combination diamond-churn drill outfit used. Holes spotted on definite systems. Continuation and extent of drilling based on results obtained as work progresses. Vertical sections constructed through lines of drill holes. Correlation of beds cut by the several holes. Division into layers and connecting between holes. Precautions to be observed.

The first explorations in the Mesabi district were carried on by test pits. The depth of these was limited to the level of the groundwater. In several cases where test-pitting developed a fairly large body of ore, shafts were sunk and the orebody developed more completely both in depth and laterally by underground workings. Several bodies explored by test pits were developed as openpits, having shafts and a few drifts and crosscuts for drainage purposes. In the middle '90s diamond and churn drills were introduced for exploration work and have been used for such work ever since. Some mining companies do their own exploration work, but a great deal of contract work is done also. Although such work is expensive, the total cost in any extensive explorations is but a few cents per ton of ore developed; this includes drilling on barren properties. As will be shown later, the drilling is so thorough and systematic that the shape and extent of the orebody are determined with extreme accuracy. Obviously such information is invaluable in the proper planning of development work, whether openpit or underground. It will be shown here how to interpret the drill explorations properly, and how to work out the structure of the orebody closely from such records.

The drilling outfit need not be described, as it is well known to most mining men. A good description of both outfit and drilling operation is given in the University of Minnesota bulletin mentioned in Part I. The accompanying illustration, Fig. 21, is a good view of the ordinary Mesabi drill outfit.

A brief account of drilling operations is appropriate, as they must be considered in interpreting drill records. A 3-in. casing pipe is first driven down through the glacial drift, locally called "surface." The drift is full of boulders of all sizes, which are blasted when encountered or are drilled through with diamonds and then blasted. Before blasting, the casing pipe is pulled up a few feet to prevent its bottom from being broken by the blast. The surface is churn-drilled and washed up out of the casing pipe after every few feet of advance of the casing. A 200- to 300-lb. cylindrical weight is used as a drop hammer to drive down the casing pipe. When the ore is encountered, the casing is driven down into it a few inches so that the surface material will not run down under the end of the pipe and become mixed with the ore sample. A 2-in. casing pipe is then put down inside the 3-in. and churning proceeds in the ore just as in the surface. Samples of the ore are taken for intervals of 5 ft. as the drilling proceeds, unless rock is encountered, in

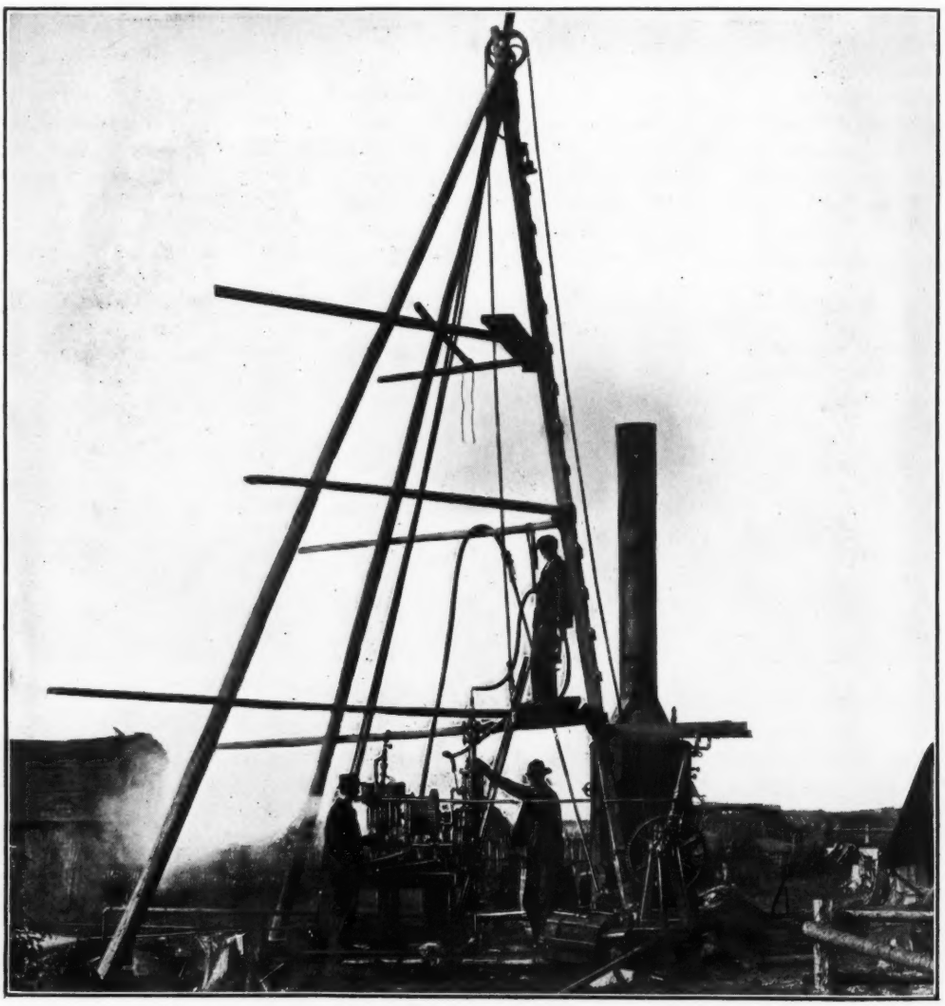


FIG. 21. STANDARD MESABI DRILLING OUTFIT

*Mining engineer, Oliver Iron Mining Co., Duluth, Minn.

which case the drill runner attempts to chop and blast through the rock. Often the rock is only a thin seam and can be cut through with a chopping bit, but if it proves to be a thick layer of taconite the chopping bit is taken off and the diamond bit put on. Then diamond drilling proceeds until ore is again encountered or until the engineer in charge of explorations decides the hole is deep enough. If more than 5 ft. of ore is encountered under the taconite, the entire depth of the taconite is blasted so that the casing pipe can be driven down through it to the ore beneath. This operation is known as blasting down casing. After the casing has been driven down to the ore under the taconite, churn drilling proceeds as before until the bottom of the ore is reached. The depth to which drilling in taconite is carried depends entirely upon geological conditions, depth of ore in adjacent holes or depth of nearby orebodies, except in case of special contracts or leases in which a specific depth in taconite is provided.

Samples Taken for Each Five Feet

In taking samples of the ore, the choppings or sludge for each 5-ft. sample is caught in three or more barrels as it is washed up through the casing pipe and is allowed to settle for two hours, after which the water is drained off and the settlings collected in a pan and dried. The sample is then divided into a number of parts to provide samples for the mining company, the fee owners, etc. These are sent to the laboratory and analyses of the material dried at 212° F. are generally made for iron, phosphorus and silica, and by some companies for manganese and alumina. Pieces of the core from that part of the lode which was diamond-drilled are saved also. The different mining companies have different methods of preserving samples, some using paper bags, some glass bottles and some specially constructed tin boxes which can be packed or filed away easily. The drill runners make reports of the material encountered to the director of explorations, generally an engineer, giving also the depth of material diamond-drilled. The chemical determinations of all samples are also reported to the exploration chief. The actual samples, choppings and core are examined by him and the material classified as to its character, whether ore, taconite and ore, paint-rock, taconite, slate, quartzite, etc. He also checks the depth of diamond drilling reported by the drill runner. From this information, that is, chemical determinations and physical classification, the record of the drill hole is platted on tracings together with records of all other drill holes on the forty.

Location of Drill Holes

The unit of ownership is a 40-acre tract, therefore the unit of exploration is generally a 40-acre tract. Before drilling is started on any property a system of drill holes is laid out on a map of the property and then staked out on the ground. Different systems are in use by different companies and each has its advantages and its adherents. No one system can be prescribed as the best for all parts of the range. The more irregular and rocky orebodies require more closely spaced drill holes. In some of the early explorations drill holes were spaced 150 to 200 ft. apart. In many cases no regular system of spacing drill holes was followed. The system most widely used at the present time and for some years past is to spot drill holes at intersections of north-south and east-west lines 300 ft. apart, giving five rows of holes each way or a total of 25 drill holes per 40-acre tract. If the property adjoins an ore-bearing property so that something is known of the possible position of an orebody the drilling is started in that part of the forty where the orebody is suspected. If nothing is known as to the probable existence of ore on the property at least five of the 25 holes are drilled. One of these holes, the one nearest the outcrop of the quartzite is drilled through the iron formation to quartzite. If no ore is encountered in any of these holes the exploration is discontinued temporarily. If the mining company controls the surrounding properties and upon exploring them finds ore near the property lines of this property in question, exploration is resumed on the abandoned property. If ore is encountered in one or more of the five drill holes which were drilled first, others of the 25 locations on the forty are drilled and the explorations are continued until the outline of the orebody is well established. The engineer in charge of explorations studies the results of the drilling carefully as it progresses and if he considers it

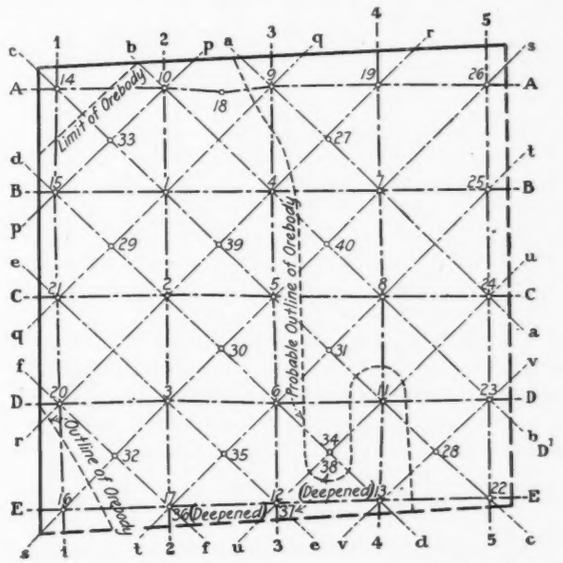


FIG. 22. TYPICAL EXPLORATION OF FORTY-ACRE TRACT

necessary, for determining either the depth of the ore or the outline of the orebody, holes intermediate between these 25 locations are put down. Even in cases where the orebody covers the whole 40-acre tract it is not always necessary to drill all of these intermediate holes. A close study of the structure of the orebody by the engineer determines the necessity of these holes. However, if all of these intermediate holes are drilled the distance between drill holes will be 212 ft. This may seem to be excessive exploration, but experience has proved that drill holes even 200 ft. apart are not too close. In many instances rock horses have been found in the orebody within a few feet of a drill hole and none of the drill holes showed any rock intrusions.

The system of drilling only five holes and abandoning the property if these show no ore is not universally used, nor is it to be recommended as the best practice, because small narrow bodies might occur between such drill holes. As a rule, at least 10 of the 25 locations ought to be drilled before abandoning the property. This of course depends much on the position of the property and is applicable particularly to properties near the center of the iron-formation outcrop or north of it. For those proper

ties near the Virginia slate five barren holes is a reasonable test.

As the drilling progresses sections are prepared to a convenient scale (40 ft. or 50 ft. to the inch) looking north and looking west. Thus there will be five east-west and five north-south sections showing the 25 holes originally laid out. If the intermediate holes are drilled, additional sections are made, looking northeast and northwest, giving two sets of diagonal sections, and the east-west and north-south sections are discarded, except such of them as may have drill-holes not shown on the diagonal

LEGEND OF FORMATIONS OF OREBODY CROSS-SECTIONS

B.O.	Blue ore	O.	Ore
B.T.	Broken taconite	P.Q.	Pokegama quartzite
C.	Conglomerate	P.R.	Paint-rock
Cret.	Cretaceous	P.R.L.	Paint-rock layer
C.S.	Cretaceous shale	P.R.O.	Paint-rock ore
C.T.	Cherty taconite	Q.	Quartzite
D.S.	Decomposed slate	S.	Slate
D.T.	Decomposed taconite	S.T.	Slaty taconite
G.	Greenstone	T.	Taconite
G.D.	Glacial drift	T. & O.	Taconite and ore
H.G.O.	High-grade ore	U.H.G.O.	Upper high-grade ore
I.P.R.L.	Intermediate paint-rock layer	U.N.L.	Upper nonbessemer layer
I.S.L.	Intermediate slate layer	U.N.O.	Upper nonbessemer ore
L.B.O.	Lower blue ore	U.S.& C.T.	Upper slaty and cherty taconite
L.C.T.	Lower cherty taconite	U.S.T.	Upper slaty taconite
L.H G.O.	Lower high-grade ore	U.Y.O.	Upper yellow ore
L.H.S.	Lower Huronian slate	U.Y.T.	Upper yellow taconite
L.N.O.	Lower nonbessemer ore	V.S.	Virginia slate
L.O.	Lean ore (40%-49% iron)	W.O.	Wash ore
L.Y.O.	Lower yellow ore	Y.O.	Yellow ore
L.Y.T.	Lower yellow taconite	Y.T.	Yellow taconite
		U.B.O.	Upper blue ore

sections, such as a section along *AA*, Fig. 22. Positions of drill holes and of sections are shown on the plat of Fig. 22, which represents a 40-acre tract explored as just described. From a study of these intersecting sets of sections an accurate knowledge of the shape, extent and structure of the orebody can be obtained.

In making a section the drill holes are platted in their proper relative locations and elevations, the latter data having been obtained previously by field engineers. The elevation of Lake Superior is the common datum plane generally used by many of the mining companies. Some companies use sea-level datum. Opposite each drill hole on the section are recorded all analyses and the classification of material. Fig. 23 shows an actual section of an orebody as developed by drill records. The chemical analyses and classification of material are shown. With the drill records thus made into sections, the structure of the orebody is worked out. Two general divisions of ore material are made. Churn-drilled material analyzing below 49% or 50% dry iron is classed as lean ore. Churn-drilled material analyzing above 49% or 50% dry iron is classed as standard ore. This, however, does not mean merchantable ore. The standard ore is further subdivided into bessemer and nonbessemer. The criterion for bessemer ore is not absolutely rigid with all companies, but an ore in which the ratio of phosphorus to iron is 0.00075 to 0.00080 is classed as bessemer; 55% natural iron, equivalent to an ore carrying 62.50% dried iron and 12% moisture, with 0.045% phosphorus, is the market standard or base for iron in the bessemer class. Of course ores somewhat lower than this in iron are sold as bessemer in the market. Most engineers in the district have been in the habit of working out the structure of the ore by joining up ore layers of similar classification lying approximately in the same horizon in the orebody and connecting the bottoms of the ore in adjacent holes either with straight lines or with regular curves. In many cases this procedure is approximately correct, but in others it leads to erroneous results.

The following description will outline the most recent and accurate method for determining the structure of an orebody. Having at hand all the cross-sections, the engineer examines the cuttings and core samples of each drill hole and divides up the entire hole into the different structural layers as shown by the sections in Parts I and II. These layers are upper blue or high-grade ore, upper yellow, nonbessemer, ore, intermediate paint-rock layer,

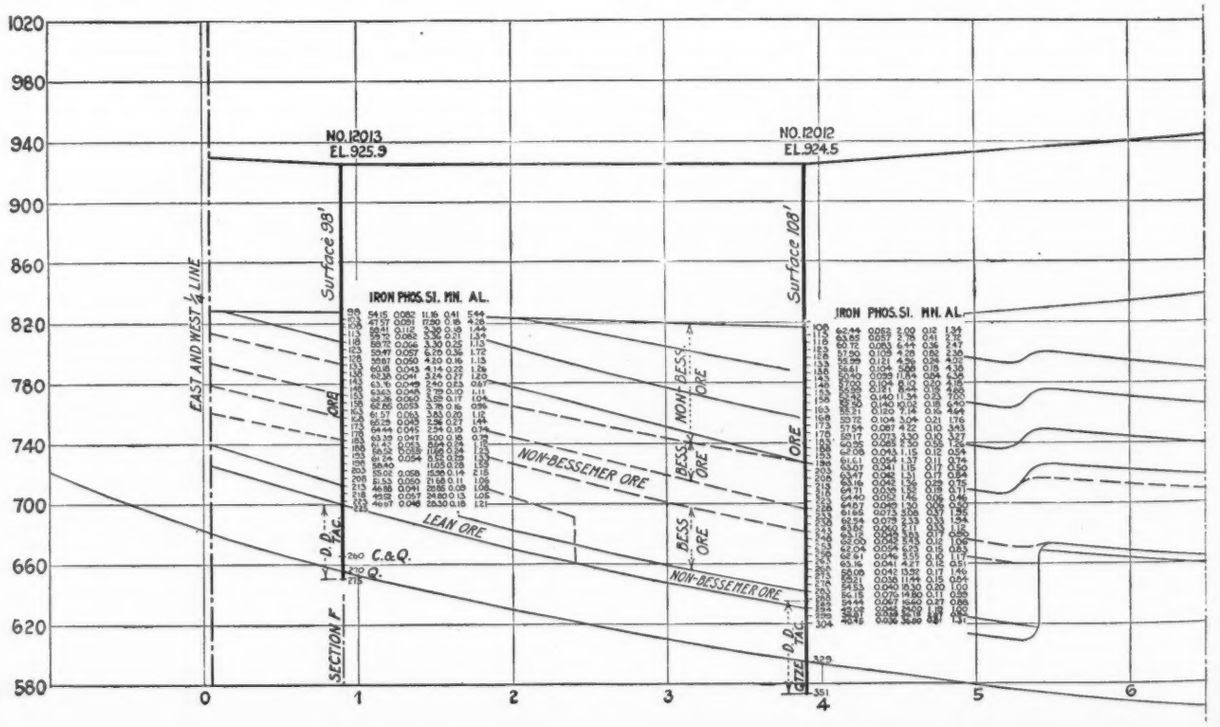


FIG. 23. SECTION OF A DEVELOPED OREBODY

lower yellow, nonbessemer, ore and lower blue or high-grade ore. The high-grade ores are generally high in iron, though not always so, and generally low in phosphorous, though not always bessemer ore. In making this division, all the drill samples, choppings and core, from a hole are laid out in order on a long table and divisions made largely from physical appearance. The paint-rock is characteristically reddish and the yellow layers are yellow. The chemical analyses help considerably in this classification also. The paint-rock layer generally is noticeably high in phosphorus and alumina, the phosphorus ranging from 0.075% to 0.300% and the alumina from 4% to 8 or 10%. The break between lower yellow ore and lower blue ore usually is marked by a sharp drop in both phosphorus and alumina, the blue ore being the lower in both elements. The division between upper yellow and upper blue ores is marked best by a drop in phosphorous, the blue ore having the lower phosphorus. This division is not so universal as in the lower orebody. The alumina in the two layers is about the same. Of course exceptions to these general statements are not uncommon.

The descriptive terms, high-grade ore, blue ore and yellow ore should not be taken literally. In the yellow-ore layers considerable red or purplish paint-rock material may occur; in the intermediate paint-rock layer, which is usually of reddish appearance, layers of yellow ocher occur, and in the high-grade or blue bodies there are found layers of paint-rock and brown ore. The terms blue ore, yellow ore and paint-rock are here used simply to describe structural layers. This division into layers is not always easy to make, but as stated in Part I the division between intermediate paint-rock layer and lower yellow ore is sharp and always can be made easily. In fact the experienced engineer usually can pick this division from the chemical analyses and classification of material. The upper 5 to 15 ft. of the lower yellow layer, just below the paint-rock layer, frequently is sandy ore or decomposed taconite. On the Western Mesabi it is almost pure sand. In any well-concentrated orebody drill holes can be found which can be divided accurately into the aforementioned layers, and will give the average thicknesses of the respective layers. With such data as a guide the other drill holes can be divided into the several layers, and such classification can be carried out even in the holes drilled in barren rock. In some well-concentrated orebodies further subdivisions can be made. The lower blue body can be divided into a bottom body of decidedly blue ore and

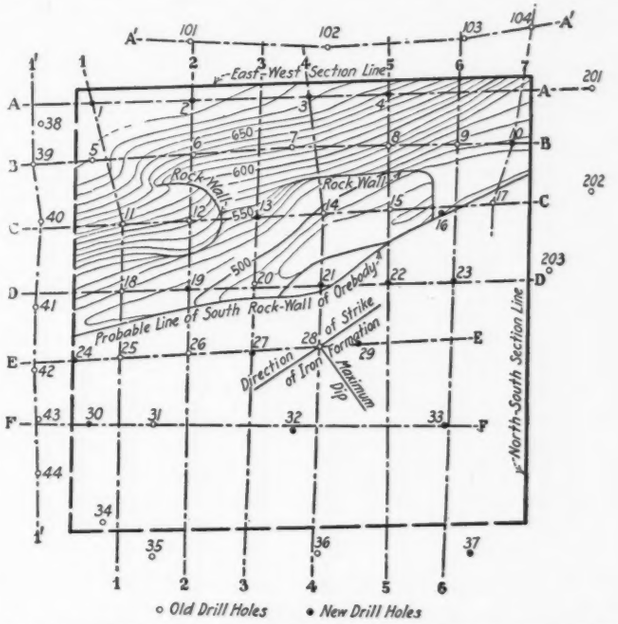
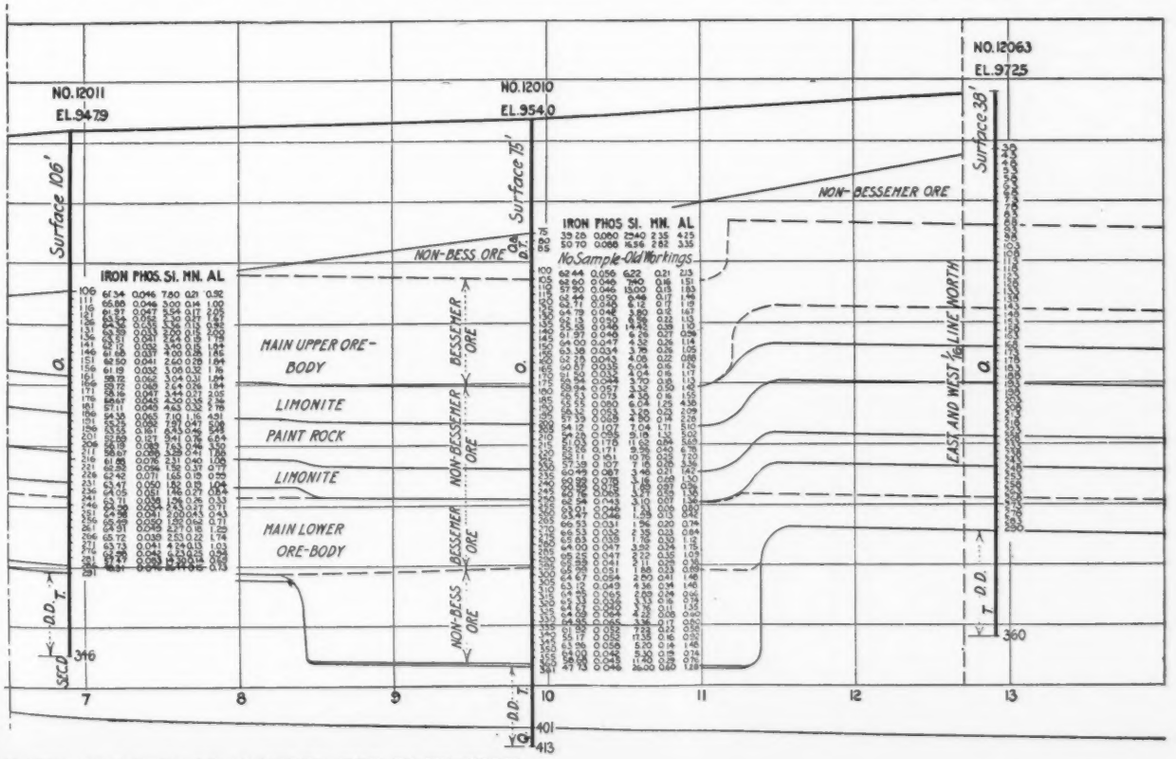
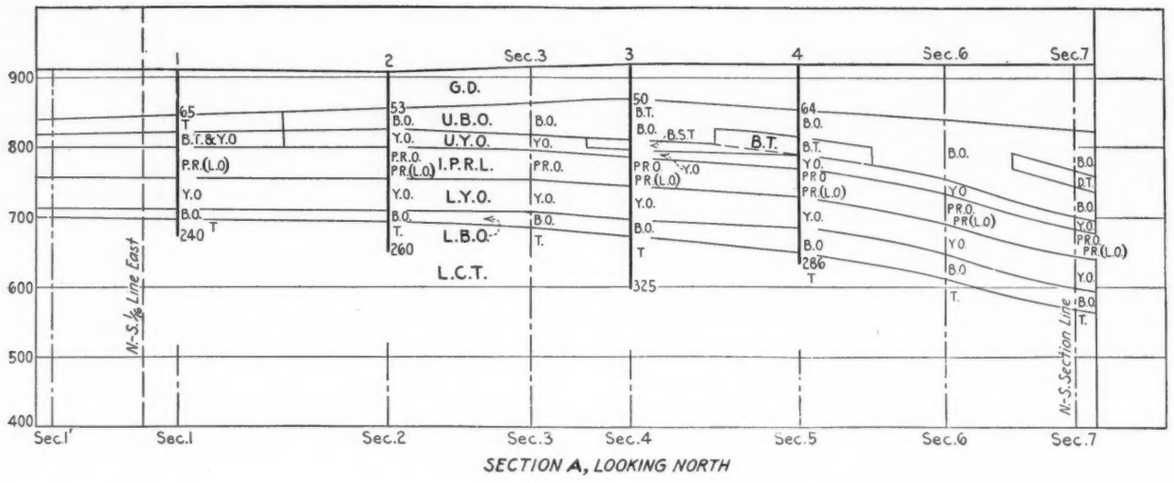


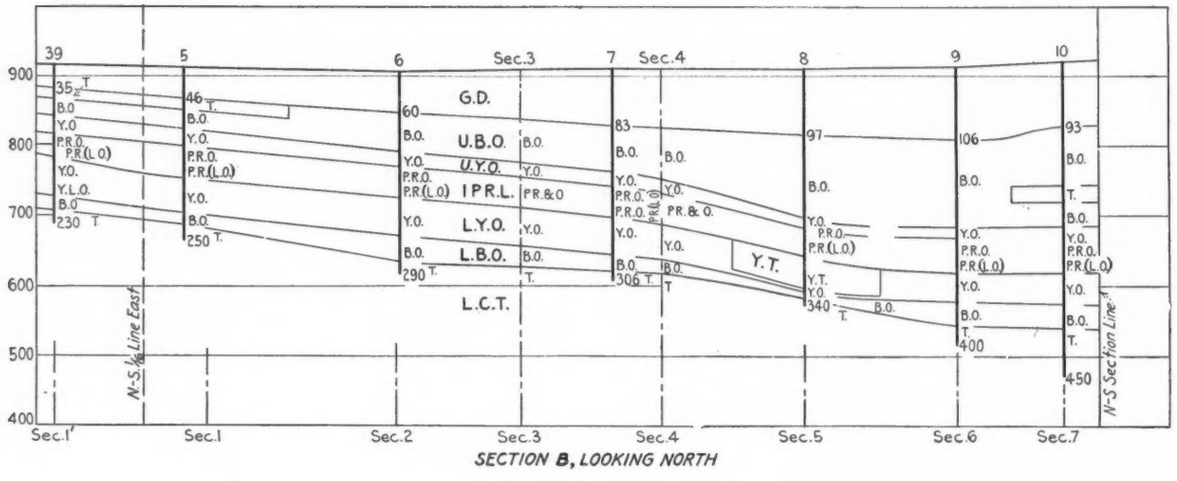
FIG. 24. CONTOURS OF BOTTOM OF OREBODY WORKED OUT FROM DRILL HOLES



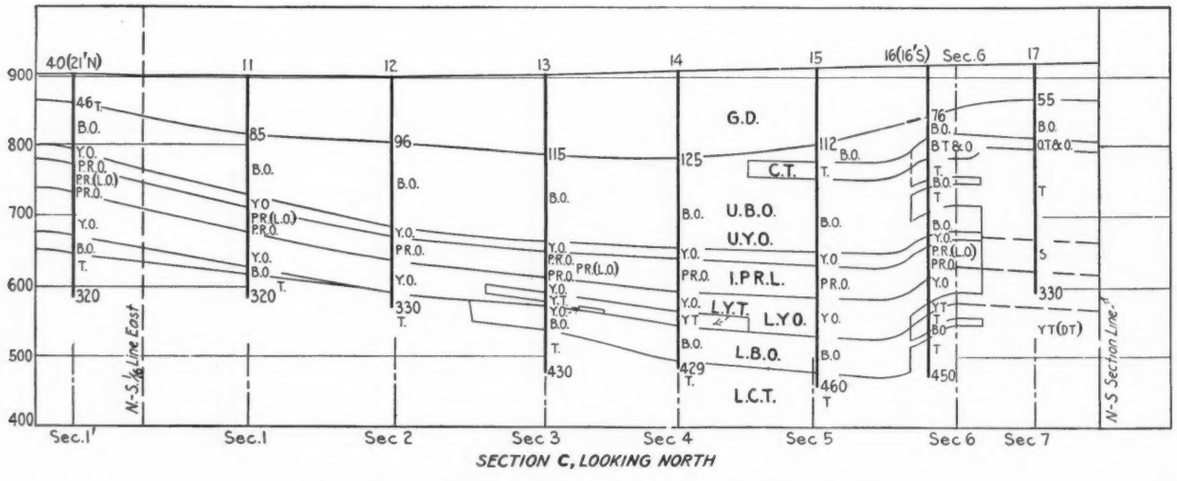
WITH ANALYSES OF SAMPLES FOR EACH HOLE



SECTION A, LOOKING NORTH

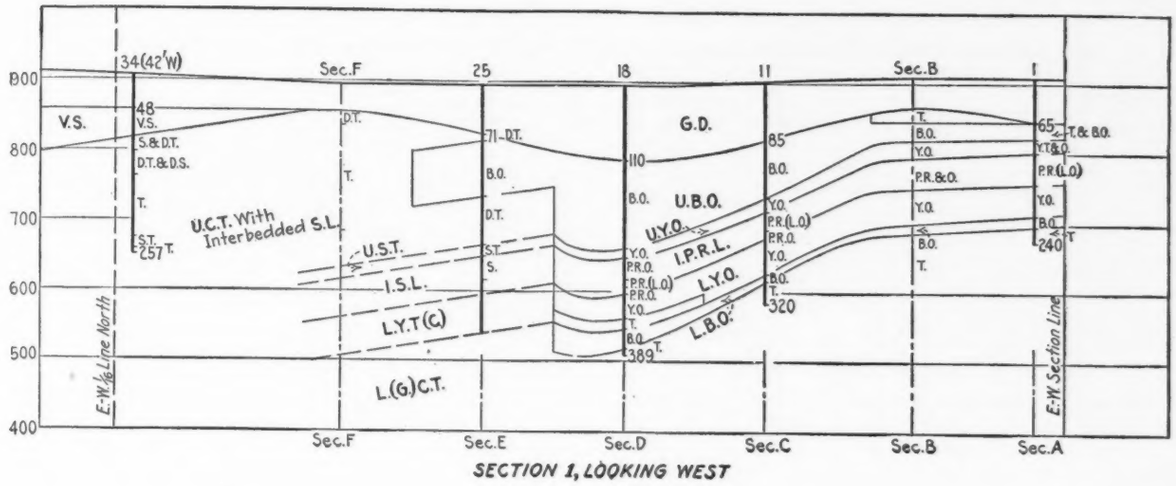


SECTION B, LOOKING NORTH

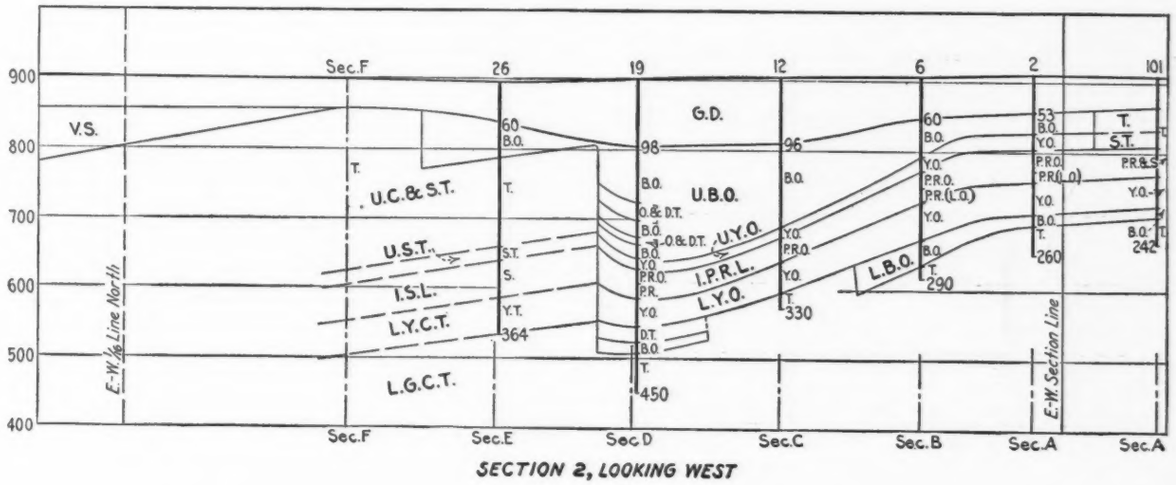


SECTION C, LOOKING NORTH

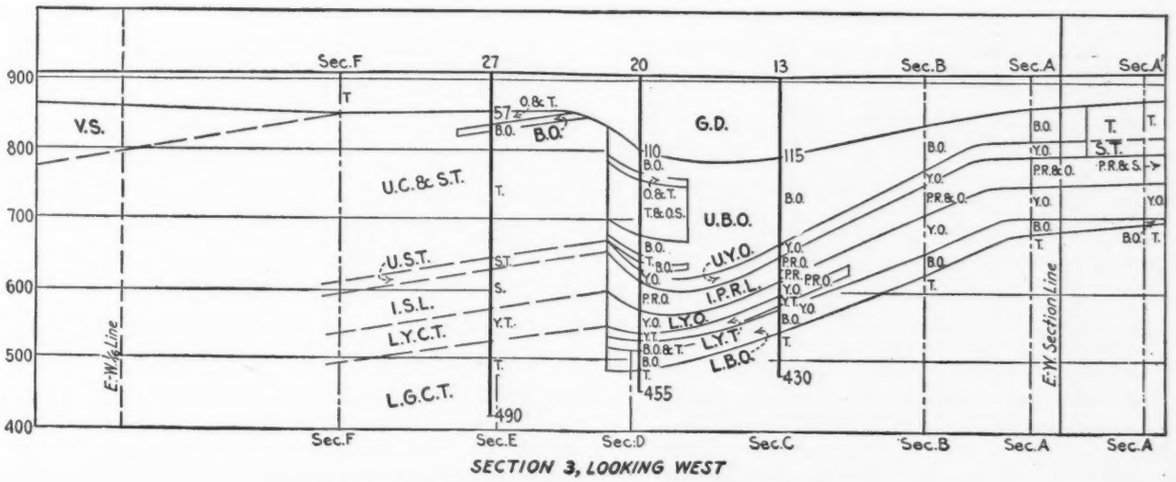
FIG. 25. SECTIONS FROM PLAT SHOWN IN FIG. 24



SECTION 1, LOOKING WEST

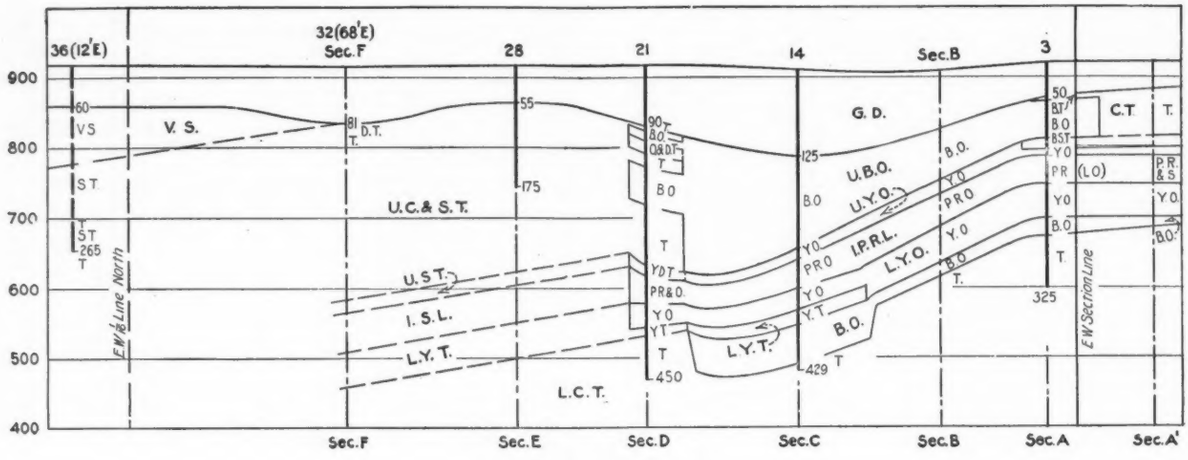


SECTION 2, LOOKING WEST

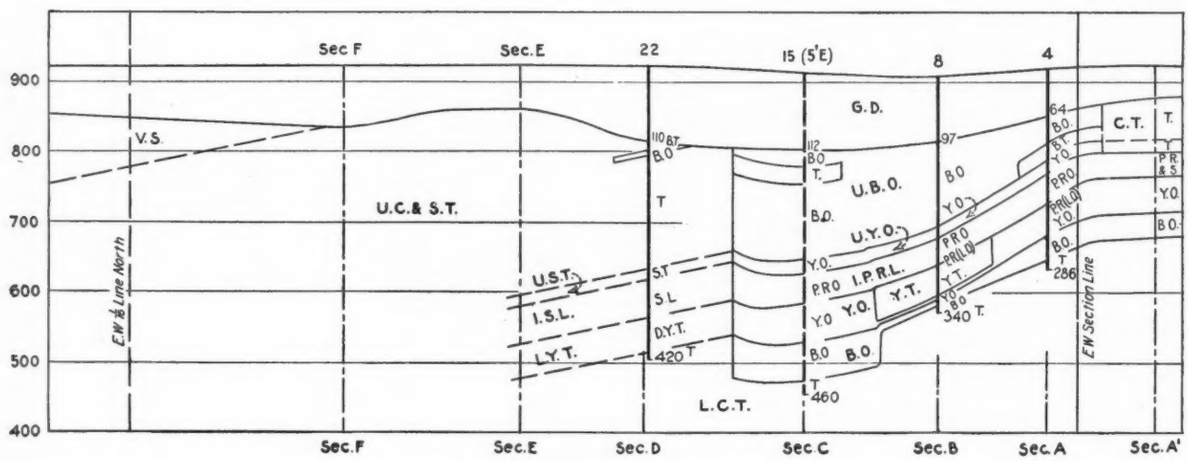


SECTION 3, LOOKING WEST

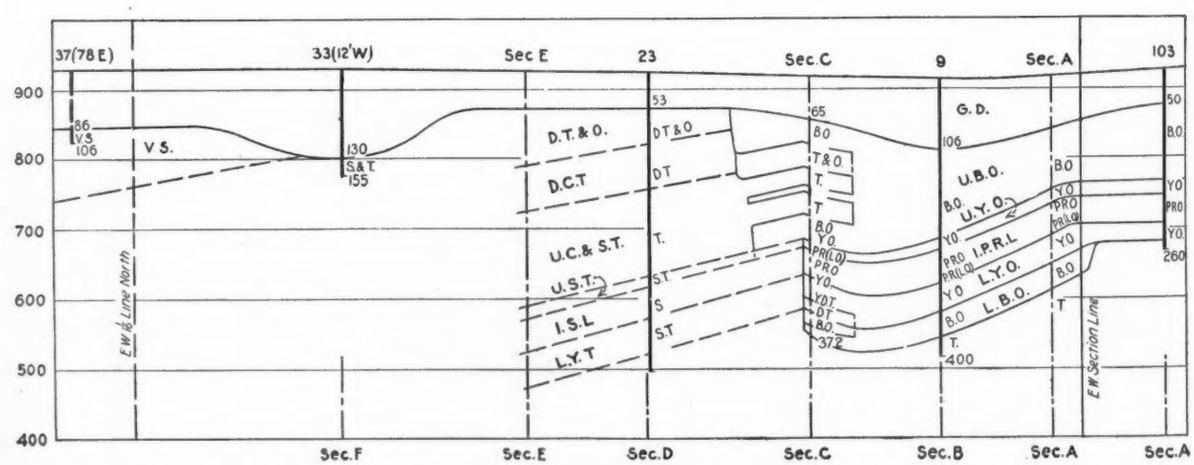
FIG. 26. SECTIONS FROM PLAT SHOWN IN FIG. 24



SECTION 4 LOOKING WEST



SECTION 5 LOOKING WEST



SECTION 6 LOOKING WEST

FIG. 27. SECTIONS FROM PLAT SHOWN IN FIG. 24

an upper brown ore, the gradation downward from the lower yellow ore. In the upper blue body an interbedded red or yellow slaty or paint-rock ore can be distinguished, being the alteration of the upper interbedded slate layer mentioned in Part I and shown in Fig. 6.

How to Correlate the Strata

When all of the drill holes have been thus divided into their structural layers, the structure of the orebody can be worked out accurately by connecting corresponding layers in adjacent drill holes on each section. Account must be taken, of course, of preglacial erosion, of slump in the orebody and of the effect of rock layers or rock horses in the ore, in connecting these structural layers. In some small orebodies which are alterations of only part of the upper taconite, and in which only a few or none of the holes have been drilled down through the Intermediate slate, the structure can be determined accurately by examining all the drill-holes for layers of slate or taconite having distinctive characteristics, and correlating and connecting such layers on the sections. Fig. 24 is a plat showing location of drill holes and lines of the sections, and bottom of ore contours of the main part of an orebody whose structure was accurately worked out along the lines described. Figs. 25, 26 and 27 show the principal east-west and north-south sections of this orebody. This plat and these sections are worthy of careful study by engineers of the district, as they combine many essential points in the working out of structure.

Attention is called to the dip of layers of rock south of the orebody. This was obtained by observing the dip of the cores of slate, particularly of the Intermediate slate layer. For this purpose a clinometer or a triangle divided into 5° angles can be used. In this particular case the dip was found to be from 15° to 23°. The strike of the formation is 55° E. as shown by the surface geological map in the vicinity. The dip observed from the drill cores was the maximum dip, at right angles to the strike. By a simple computation the dip on a north-south section was determined to be from 9° to 14°. One must take care in determining dip from rock cores not to use dips of ore seams in the taconite, because these may differ considerably from the dip or bedding of the whole formation. The slate cores give the best bedding and dip.

Attention is also called to drill holes 16, 20 and 21 which are near the south rock-wall of the orebody. Observations of slate cores found in the samples from these drill holes showed a dip of about 5°. Since the average dip of the rock south of the orebody is about 19° the small dip of 5° in these drill holes is taken to mean that the dip is down to the north and that these holes are north of the south rock-wall of the main orebody. On the sections it can be seen that these holes contain a great deal of rock, which is further evidence that they are near the limit of the ore. Furthermore the analyses of the ore in these drill holes was low in iron and fairly high in silica as compared with the drill holes to the north in the main part of the orebody. All this evidence was used in locating the line of the south rock-wall as shown in Fig. 24. Of course this information may be interpreted differently by different engineers, but it is presented here to call attention to facts and data which are not taken into consideration by most engineers in developing structure. Obviously the exact location of a rock wall is a matter of considerable importance, particularly in the development of openpits. In many cases considerable rock area might be stripped unless the drill records are studied carefully and interpreted along the lines just indicated.

The orebody shown is unusual in that the layers have so pronounced an initial southerly dip. The average dip of the iron formation is only 6° to 7°, instead of 19° as in this case.

In working out structure it is not entirely necessary to divide the orebody into all of its different layers; in fact it is often difficult to do so; but it is always possible to determine the division line between the intermediate paint-rock layer and the lower yellow ore, and with this division established on all sections as a guiding structural line, the essential structure can be worked out by drawing all ore layers shown by drill-holes on lines parallel to this structural line. In applying this rule the engineer must bear in mind the effect of rock layers and pillars and slump in deep parts of the orebody.

Good Drilling Makes Easy Work

After the deposit has been divided into its structural layers on the sections, the bodies or layers of lean ore and standard ore and bessemer and nonbessemer ore can be connected. The great value of the structural work really consists in being able to connect these different grades of ore with the certainty that they exist in the ground approximately as connected on the sections. Since the Mesabi iron formation is sedimentary, the alteration and concentration have proceeded along bedding planes, and lean layers or high-grade layers do not connect across the bedding. Therefore the great value and importance of this structural work should be apparent. It can hardly be over-emphasized. It is not only important in openpit development but is even more important in planning underground drift systems. One can easily see that if the structure is not worked out properly drifts may be planned which will drive into rock where ore was anticipated, and *vice versa*. Furthermore during the exploration of a property this structural study is a great aid to exploration and in fact is the best way to direct exploration. Such structural study shows plainly to the director of exploration where additional holes may be necessary or where some proposed holes may be superfluous. A case in point may be seen on Fig. 24; a drill hole intermediate between drill holes 18, 19, 25 and 26 and one say 100 ft. north of drill hole 22 would locate quite accurately the actual south rock-wall of the orebody shown on this plat.

Important to Supplement Drill-Hole Records

With the structure accurately determined as outlined, mining operations, whether openpit or underground, can be conducted much more skillfully than could be done otherwise. Development and mining work, whether test-pits, steam-shovel cuts, or underground drifts and raises, will give additional information as regards the structure, and all of this can be correlated and used to supplement the structure as shown by the drill-hole sections. Especially in openpit work is it necessary to keep in mind the ore structure in estimating the grades of ore which will be produced in a certain season. Of course most mining companies supplement the drill records by sampling the cuts made by the shovels and by test-pits, but to be of value all such information must be correlated structurally.

(To be concluded)

Details of Practical Mining

Wood vs. Steel Mine Ladders

By George E. Collins*

In the *Journal* of May 29 is a note with sketch by my friend E. S. Wiard, about steel ladders used at the Capital mine, Georgetown, as to which I wish to suggest a word of warning. In most mines such ladders would be unsafe. Moisture is apt to collect behind the rungs where the latter are riveted to the sides. This results in rust, and when the rivet has rusted through the ladders are very dangerous, as the defect is not visible. Steel ladders should be used only where liability of dry rot renders wood unsuitable; and even then I believe a design in which the pipe rungs actually pass through the sides would be safer and more generally preferable. Even in a dry mine there is usually moisture enough to develop rust on metal surfaces, especially when two such surfaces are in approximate but not actual contact.

In my experience, light weight in ladders is ordinarily a matter of secondary importance. Where a length of

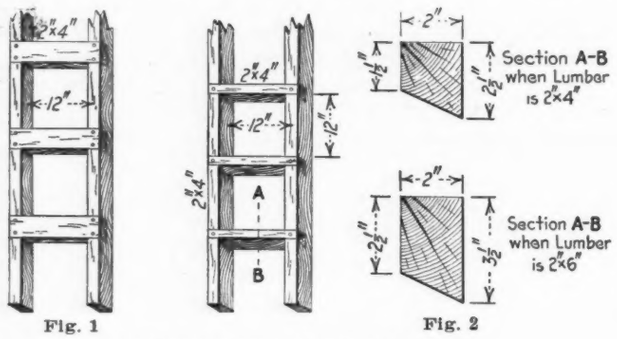


Fig. 1 Fig. 2

LIGHT WOODEN MINE LADDERS

ladder has to be moved frequently, very light ladders will of course be built. Ladders are intended primarily to travel on; and next to safety, convenience in climbing is the most important requisite. Pipe or other metal rungs are cold to the hands, and when wet and gritty cut the skin more than wooden rungs. Moreover, pipe is slippery and does not afford so good a grip for the feet as wood.

In most places, wooden ladders are best. Probably the most generally suitable design, taking convenience and cost into consideration, is that shown in Fig. 1, where sides and rungs are both made of 2x4 stock, the rungs being inset 1 or 1½ in. into the sides. If neatly made of dry lumber, the rungs swell when wet, so that they are firmly held in the slots, even if the nails with which they are originally secured should rust out. Worn rungs are easily replaced—an important consideration, for the neglect of which there is no excuse—and even when a rung is worn through or broken, the pieces hold sufficiently for safe travel. Such ladders made of red spruce, at a high-altitude mine in Colorado, cost 10½c. per foot complete as against Mr. Wiard's figure of 25c. per foot for the steel ladders. Their life, apart from damage by falling rocks—which in my experience is equally destructive to the 1- or 1½-in. pipe—is very long, sometimes exceeding that of the mine itself.

Where the ladders are exposed to the drip of acid water, I have used the form shown in Fig. 2. Here the rungs are made of 2x4 or 2x5 lumber, sawed on an angle lengthwise, so as to make pieces of the section as illustrated 1½ in. one side and 2½ in. the other, when sawed from 2x4 lumber, or 2½ in. and 3½ in. respectively, when sawed from 2x6 lumber. In either case, one cut in the side pieces is made at right angles and the other obliquely, so that the rungs are firmly held without nails. Of course the flat side of the rungs is placed uppermost. These ladders cost but a trifle more than the first mentioned.

Where there is liability of dry-rot, I have used 2x4 lumber for the sides and old pipe sawed into lengths for rungs. If the holes in the sides are a tight fit, no other fastening is necessary. I do not know why wooden uprights last so much longer than rungs—to a greater extent than the increased section would suggest—but such, in my experience, is the fact. The sides might be dipped in creosote or treated with copper sulphate, although I personally have not tried either. Either preservative used on wooden rungs, would be a nuisance.

The facility with which the sides of wooden ladders may be spiked to timbers or fastened to one another by means of cleats is much greater than that by which steel ladders can be suitably fastened by hooks or staples. Of course the advantage mentioned by Mr. Wiard, of each section being supported by the others, may and usually does apply to wooden ladders as well as to those made of steel.

In the old district of Gilpin County, ladders usually have sides of 2x4 lumber, with rungs made either of round 1¼-in. hardwood or of 2x2 native lumber chamfered at the edges and turned down at the ends to 1¾ in., which fit closely into a round hole of equal diameter in the side pieces. A nail through the side into the rungs at each hole adds some further security. These are good ladders to climb, but are not quite so safe as those made of 2x4 slats nor so durable. They retail at the rate of 12c. per running foot.

Slats made of 1x3 or 1x4 are sometimes used, but are not strong enough, and give poor footing. They should be used for movable ladders only.

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Why Is a Stinker?

The large volume of poisonous gases produced by the burning of a powder charge in a drill hole and delicately designated as a *stinker* is also similarly produced from causes other than burning of the charge. If the explosive has aged to such an extent that its sensitiveness has materially decreased; if the explosive is in a frozen or partly frozen condition, or if too weak detonators are used, an incomplete and improper detonation of the charge will

result and an unusual volume of poisonous gases will be given off. Many of the burned-out holes which are unexplainable, in view of the care taken in making the primer, selecting the fuse and loading the hole, are in reality not burned out at all, but simply the result of incomplete and improper detonation from one of the causes enumerated.

Rocker and Grizzly Mining on the North Saskatchewan

By J. A. Macdonald*

The newly discovered placer mining on the North Saskatchewan River which is now being vigorously prosecuted by the rocker and grizzly methods, recalls the early days of the Klondike when those crude implements were the only methods of mining the gold of the Yukon where today the mighty dredge does 75% of the mining. In the early days the "dirt" being rich, there was big money for the miner and prospector in operating the rocker, the grizzly and the sluice-box. One hundred dollars a day was not an uncommon output for the Yukon miner in the late '90s, and anything less than a "10c. pan" was not worth bothering with. The rocker and the grizzly are used yet to some extent in the Yukon, but the sluice-box has largely taken the place of those appliances where hand-mining is still pursued.

The grizzly is a modification of the sluice-box; it is in fact a section of a sluice-box, and is used where running water is not available. The rocker is a cruder affair, and is now chiefly used by the prospector in determining the value of a find. Running water is not necessary with the rocker, for the water can be used over and over again.

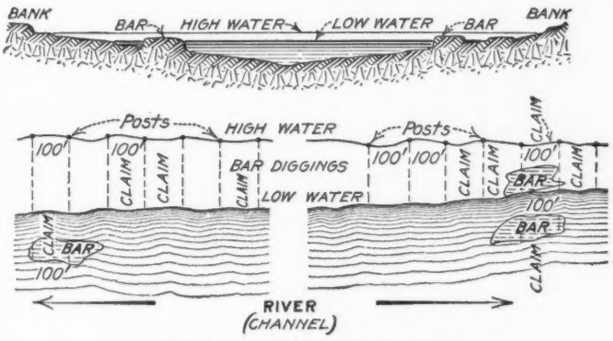


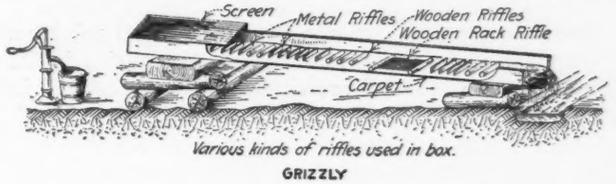
FIG. 1. LAYOUT OF CLAIMS

In the new diggings on the Saskatchewan, the grizzly and the rocker are the only methods thus far used. There is plenty of water in the Saskatchewan, it is true, but in order to use it for sluicing expensive machinery is required. These diggings known as "bar diggings" and "tidal diggings," can only be operated in certain parts of the year; that is, when the water is very low in the river; so it would scarcely pay to install expensive machinery. "Bar diggings" are covered with water until fall, when the bars are exposed and digging for gold begins. With the freeze-up the work stops, of course, only to begin again just before the ice breaks up in the river previous to the spring floods. Before the last freeze-up between two and three hundred claims had been taken up, and large numbers of claims have been staked out since.

Along the bank of the river only 100 ft. is allowed any one prospector. These narrow claims may, however, extend out a considerable distance over the flats and bars. The "shore" of the river may extend out in some places several hundred yards, and "bars" show up in areas of an acre or more at low water. These bars and banks are where the gold is found mixed with the fine earth and sand. The layout of these claims is given in Fig. 1. New regulations covering those placers have had to be issued by the Mines Department of the Interior. By the general mining regulations in the Western provinces and the Yukon a mining claim for gold or other precious metals is from 500 to 1500 ft. in width. Here, however, the width is but 100 ft.

In order to prevent the speculator, with no intention of working them, from acquiring valuable claims, the Government regulations provide that any person who, having staked out a claim, ceases work for three consecutive days during the working season sacrifices his claim, unless a "lay-over" has been granted him by the mining recorder. This regulation is very necessary and quite fair.

In Fig. 2 a sectional view of the rocker is shown. It is a box-like contrivance about three feet long by two



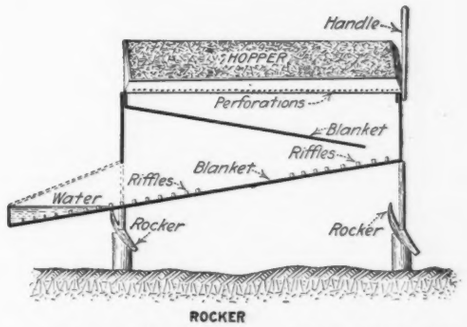


FIG. 2. DETAILS OF ROCKER AND SLUICE BOX

feet wide, with a separate box or "hopper" on top, and stands on rockers, similar to those on the baby-cradle, hence the name. Inclined shelves covered with blankets to catch the fine gold are placed inside the box. The illustration shows but one in addition to the inclined bottom, but sometimes there are two or more, all covered with blankets. The bottom incline is covered both with blanket and riffles. The water at the outlet is usually held in place and used over and over again. The bottom of the upper box or hopper is perforated with holes about ¼ to ½ in. diameter and is usually of metal. Sometimes the bottom is heavy galvanized netting, which allows the fine gravel to fall through and the rough dirt and stones to be thrown out. Water is added to make a thin grout, and in this grout is the free gold, which is collected as it falls on the blanket and on the riffles. The rockers are necessary to agitate the wet dirt and

*Box 83, Ottawa, Ont.

water in the hopper, so that the finer parts may work through. There is a handle to the rocker with which the operator works or "rocks the cradle." At the same time he adds fresh water to the hopper, taking it from the spout with a long-handled dipper. Not much water is needed.

The rocker is placed on two posts set in the ground, as shown, or is placed on scantlings, if obtainable. There is a short bolt in the center of each rocker which enters into a corresponding hole in the post or scantling to hold the rocker in place and prevent its sliding away.

Construction and Use of the Grizzly

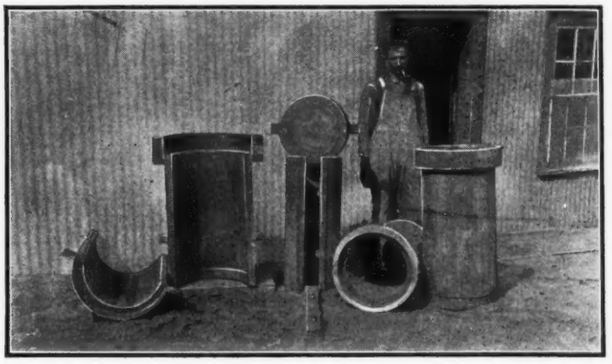
The grizzly is nothing more than a section of sluice-box about 10 ft. long, 1 ft. or more wide and 6 to 8 in. high. On its bottom riffles are set or nailed for the same purpose as in the case of the rocker. The box is set on an incline and the water and dirt are fed at the end courses down the incline, the riffles holding the free gold. The grizzly requires much more water than the rocker, and can be used only where water is fairly abundant. The riffles are made in many ways, but usually are of iron laid across the bottom of the box so as to stop the fine dirt in suspension as it slowly flows down the box. The first used in Canada was the wooden rack-like riffle. This was the only kind used in the Klondike for many years and is yet used on the Stewart. Small poles, an inch or more in diameter, are placed side by side in the box, longitudinally, and are either nailed or fastened in a rack at both ends, as shown. These poles are an inch or less apart, and are 3 to 6 ft. in length. These placed in the bottom of the box answer the purpose of holding the fine dirt, while the coarse and poor dirt flows over and out at the other end. A piece of carpet or heavy blanket is used near the end, and often both riffle and blanket are utilized in combination. Ordinarily the riffle is a piece of wood about 2 in. square, cut in lengths to fit crosswise of the box. They are placed about 6 in. apart. Riffles are, however, made in different shapes but all answer the same purpose.

Sewer Tile of Concrete

By B. B. Hood*

Concrete sewer tile is something that can be made to advantage around a mine or smeltery, especially when it is desirable to keep a skilled mason—or an unskilled one for that matter—busy rather than to lay him off when repair jobs are few. The illustration shows the forms used and two 15-in. concrete sewer tile completed. The tile are 39 in. long, including the 3-in. bell, and are 1½ in. thick, with no reinforcing of any kind. The outside form is made in halves of ¼-in. dressed-pine staves 34½ in. long held in place by two bands of iron screwed to the outside. One of the bands is 7 in. wide and projects 4½ in. beyond one end of the stave form, thereby providing the outside shape for the bell. On the inside of the opposite end is nailed a wood strip ¼ in. thick and 3 in. wide which makes the end of the finished tile 17½ in. outside diameter. The inside form is made of two parts hinged together, which, with a single keying piece makes a cylinder 15 in. diameter by 36 in. long. A taper core of wood, 3 in. thick, with diameters of 18 and 18½ in. completes the set and is used to form the inner part of the bell.

In assembling, the outer forms are placed on boards which make a bottom and are bolted together with six ¼-in. stove bolts. The key is placed in the inner form, being secured by pins through two lugs. This form is placed inside the outer one. For the first tile it was centered at the bottom by dropping three 1¼-in. cubes of wood, between the two forms and about 120 deg. apart. Trouble was caused by these blocks floating out of place when the concrete was put in. This was remedied by putting in three ½-in. setscrews, similarly spaced, near the bottom and through the outer form. As soon as 8 or 10 in. of concrete is in place, there is no danger of



FORMS AND COMPLETED CONCRETE TILE

the center form shifting, so the setscrews are turned back till they are flush with the inside of the form thereby freeing them from the tile. The center form is then filled to the top with concrete and the bell core put in place and filled around.

The concrete is really a mortar, being made of cement and sand tailings, from a concentrating mill, from which the slimes have been washed. Three bags of cement are used to make five tile. The forms are liberally coated with grease to keep the concrete from adhering to the wood and iron. A cheap grade of paper was tried instead of grease, but was not satisfactory.

Five sets of forms complete, cost $64. They were well made, of good material and were as good as new after making 300 ft. of tile. The cost of 210 ft. of these 15-in. tile was, $39 for labor and $30 for supplies, making a total cost of 33c. per running foot, with no allowance for cost of forms. The five forms were filled twice a week. They could be removed after three days, the tile standing where cast for three or four days more to harden. The tile was made indoors and therefore was sheltered from sun and rain while hardening. A week after it was cast it was rolled out-of-doors.

The method of testing one of the tile, eight days after it was cast was as follows: A smooth place was made in the sand and the tile laid upon it. The sand was dug out from under the bell so that little or no weight came upon that part. (Notice that the tile had no side support as it would have had in a culvert.) Full cement sacks were piled upon it, weighing approximately 100 lb. each. The tile broke just after the twenty-seventh bag was in place making the load 900 lb. per linear foot.

*Mining engineer, Chrome, N. J.

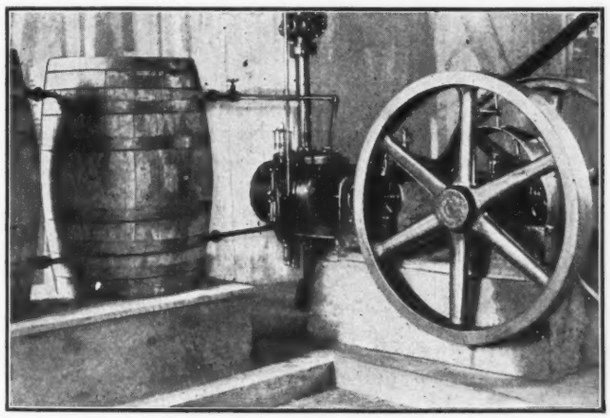
Details of Milling and Smelting

Air-Compressor Cooling With Water Barrels

By Jesse Simmons*

It is not always convenient to erect a tank, or even to secure the necessary water for cooling an air compressor by the usual method of a constantly flowing stream through the water jacket. Especially is this so in underground installations of small compressors to operate one or two hammer drills. It also applies in the desert country.

To overcome the difficulty, many operators arrange for a thermic circulating system of the cooling water by connecting two or more barrels with pipes at tops and bottoms. From the compressor a pipe is run from the bottom of the water jacket to a point near the bottom of the first barrel. From the top of the water jacket a connection is made near the top of the barrel. The accompanying illustration gives an idea of the character of the piping, showing an installation at the Echo Gold Mining Co.'s plant at Maitland, S. D. The compressor



WATER BARRELS FOR COOLING COMPRESSORS

is a single-stage belt-driven Bury machine with 6x8-in. cylinder. The water-jacket connections are made with ½-in. pipe. Between the two barrels—one shown complete and one in part—¾-in. pipe is used. Later a valve was put in the lower connection between the first barrel and the bottom of the jacket. Then by closing the two valves and opening the union on the bottom pipe and petcocks on the water jacket, the water could be readily drained on cold nights. Of course it is necessary at all times to maintain the water in the barrels at a point an inch or so above the top connections. The addition of a bucket or two of water daily replaces that lost by evaporation.

[If the night temperatures do not drop to much below 0° C. it is not necessary to drain off the water, as a little glycerin or alcohol, or some calcium chloride can be added to the water, just as is done in automobile engines.—Editor.]

*Mining engineer, Deadwood, S. D.

Lead Acetate and Zinc Salts in Silver Extraction

By Charles R. Morris*

The experiments described here were made at the Mexican mill, Virginia City, on the effect of lead acetate and zinc salts on the extraction of silver from ores, and also with the idea of finding some method, other than empirical, for the determination of the amount of lead acetate to be used for a given silver ore.

After laboratory tests were made on the ore the extraction appeared to be slightly better when using lead acetate in new solutions, but slightly poorer when using mill solutions. This was attributed to the zinc accumulating in the mill solutions. As the Mexican mill is a continuous-treatment plant, it was decided to run long mill tests with and without lead acetate, keeping all other conditions as nearly the same as possible. The ore was ground so that 92% would pass a 200-mesh screen. The temperature was kept at 95° F., cyanide at 2.5 lb. KCN, and lime at 0.5 lb. CaO. The accompanying table shows averages for each period.

The zinc was determined daily by direct precipitation as sulphide. The reducing power of the solution was also determined. No connection could be found between the extraction and the reducing power. The extraction of silver was 3.2% better in the second test than in the first, the time of treatment was 18% less in the second than in the first, and the consumption of cyanide was ¼ lb. more in the second than in the first.

During test No. 1 we found lead at head of the zinc sump solution by Clennell's method.[1] I believe the

AVERAGE RESULTS OF MILL TESTS

	Test No. 1	Test No. 2
Length of test, days	92	72
Tons per day	72	85.5
Silver, oz., heads	15.88	17.97
Silver, oz., tails	2.22	2.24
Extraction, per cent.	84.2	87.4
Acetate, lb. per ton	0.9	nil
Zinc, grams per 100 c.c. solution	0.0848	0.0168
NaCn, lb. per ton of ore	1.875	2.125

accumulation of zinc in the first period was due to the use of lead salts and that the amount of zinc in solution should be kept as low as possible, or rather that there should be only sufficient lead or zinc salt in solution to precipitate the alkaline sulphides. An excess amount of metals in cyanide solution will retard the rate of extraction. As alkaline sulphides will precipitate lead, zinc and silver out of cyanide solution, in the order named, a daily estimation of zinc should be made to determine whether the silver is protected or whether it is in excess.

During 1913 the Mexican company took over a lease on the Monte Cristo mine and I did more work along these same lines. Before starting the mill on this ore, two series of laboratory tests were made—one with freshly prepared solution and the other with mill solution from

*Superintendent, Mexican mill, Virginia City, Nev.

[1] "Engineering and Mining Journal," Sept. 8, 1912.

Mexican ore—varying the proportions of solution to ore and the amount of lead acetate. The tests made with new solution showed that a dilution of 1:10 gave a maximum extraction without lead acetate, while at a dilution of 1:2, which would be more nearly mill-working conditions, the maximum extraction was obtained with 1½ lb. of lead acetate.

Tests made with mill solution at a dilution of 1:10 without the use of lead acetate gave maximum extraction, but slightly lower than that obtained with fresh solution. With a dilution of 1:2 the maximum extraction required ¼ lb. of lead acetate. Besides, an excessive amount of lead gave poor extraction in all tests. Judging from this information, the amount of zinc salts in solution appears to have some relation to extraction.

Upon starting the mill on this ore I determined not to add any lead salts until the zinc salts were lower and some marked change of extraction of silver occurred.

Daily tests were made for zinc and for alkaline sulphides by the nitroprussiate test. The results are shown in the accompanying table.

MILL TESTS ON MONTE CRISTO ORE

	Heads. Oz. Silver	Tails,* Oz. Silver	Acetate, Lb. per Ton Ore	Zinc, Grams per 100 C.C.
1	6.12	2.20	nil	0.0650
2	5.17	1.54	nil	0.0420
3	5.04	1.58	nil	0.0380
4	6.96	1.56	nil	0.0380
5	9.21	1.76	nil	0.0203
6	16.62	1.80	nil	0.0124
7	15.72	2.18	⅛	0.0050
8	11.59	3.03	⅛	0.0050
9	11.21	3.95	⅛	trace
10	11.63	4.60	½	trace
11	13.79	3.04	¾	trace
12	13.26	2.65	¾	trace
13	18.83	2.10	1¼	0.0050
14	10.03	2.09	1¼	0.0168
15	14.36	1.67	1½	0.0168
16	10.46	1.46	1¼	0.0230
17	14.56	1.37	1¼	0.0295
18	8.31	1.07	1¼	0.0395
19	5.51	1.21	1¼	0.0346
20	5.50	1.14	1.0	0.0356
21	5.03	0.80	1.0	0.0380
22	6.15	0.74	1.0	0.0320
23	4.88	0.54	1.0	0.0340

*The tails for a given day are for heads three or four days previous.

The table gives the silver content for heads and tails, the amount of lead used and the amount of zinc in solutions returning to the head of the gold tanks.

In testing for alkaline sulphides we were unable to detect any, but from the cleanup made during the period when no zinc was in solution matte was formed on our bars. This was the only time we had matte. I believe that alkaline sulphides must have been in solution at that time. During the period we had trouble in titrating with silver nitrate. After first adding silver, a dark brown precipitate would form, which would disappear on shaking, and the final precipitate would be dark.

Complex cyanide solutions were made in the laboratory to test for alkaline sulphides by the nitroprussiate method. It was found that cyanide solutions containing small quantities of sulphide would react with nitroprussiate only in absence of silver or zinc salts.

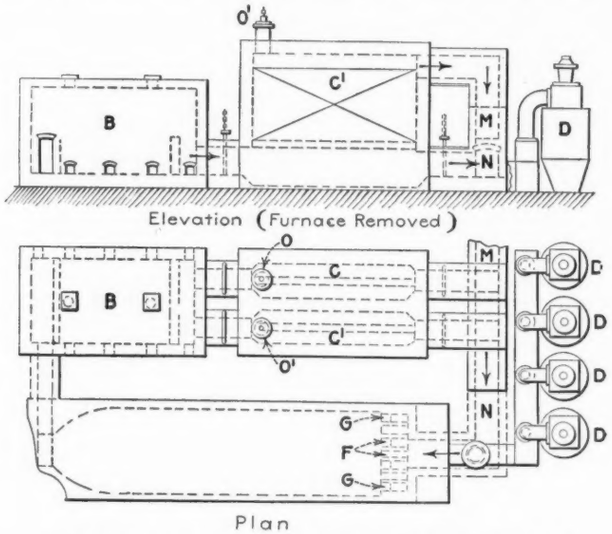
New Method for the Preparation of Copper Sulphate

A new method for the technical preparation of copper sulphate has been proposed by T. Falciola, according to the *Journal of the Society of Chemical Industry*, in the issue of Apr. 30, 1915. A hot mixture of sulphur dioxide and air—that is, the gas from sulphur or pyrites burners—is passed upward through a glass tower surrounded by a hot-air jacket and packed with copper turnings or shot. Nitric acid, or nitrous gases, are introduced at the upper end of the tower. Copper sulphate free from nitrate has been obtained in this way in laboratory experiments, and it is suggested that towers packed with copper might be used in place of Glover towers in the manufacture of sulphuric acid by the chamber process.

Perkins Gas-Fired Reverberatory Furnace

Walter G. Perkins, of London, has been granted a patent (U. S. pat. 1,136,834) for a gas-fired reverberatory furnace, the gases from which pass through an enlarged dust chamber and then into a checker-work regenerator having two chambers which are worked alternately. The construction is, in effect a non-reversible gas-fired regenerative reverberatory furnace.

The accompanying drawing shows a typical plant. The gas producers *D* are placed as near the furnace as practicable, and the gas flows through the collecting flue to the gas ports *F* of the furnace. Issuing from these the gas meets the heated secondary air from the ports *G*,



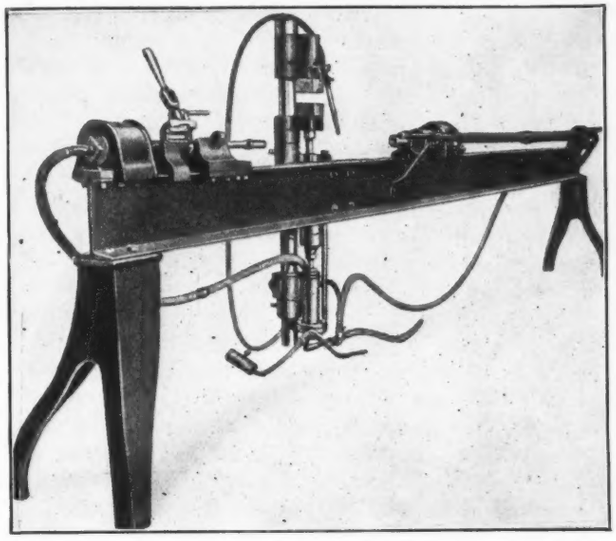
NONREVERSIBLE GAS-FIRED REVERBERATORY FURNACE

which has come from the regenerator. The waste gases from the reverberatory pass to the dust chamber *B* upward through the generator and thence to the chimney through the flue *M*. The regenerator chambers *C* and *C*¹ are constructed in the usual manner with checker-work and are used alternately. On top of each regenerator chamber is an air-admission valve *O* and *O*¹ permitting the air to flow downwardly through the regenerator chamber into the secondary-air flue *N*, and thence to the reverberatory furnace. It is expected that the passages of the regenerator will be kept clear of dust which may be carried along with the gases by providing an updraft of such gases through the regenerator and a downdraft when the chamber is used for secondary air. The use of reversible regenerative furnaces for copper smelting proved unsatisfactory in the past largely on account of dust troubles in the regenerator which the inventor claims to have obviated in the present design.

Mining & Metallurgical Machinery

The Wonder Drill Sharpener

A new drill sharpener of unusual type is being put on the market by the Hardsocg Wonder Drill Co., of Ottumwa, Iowa. This machine, although suitable for sharpening any style of hammer-drill steel, is very light, weighing only 1200 lb., and consists of the usual two elements,



WONDER DRILL SHARPENER

one horizontal and one vertical, for upsetting the drills and forming the wings. Both of these elements are mounted on an I-beam, which constitutes the main frame of the machine, which is supported on two pair of legs like an engine lathe.

This machine is claimed to have all of the advantages of any machine sharpener plus the additional advantage that it requires only 40 ft. of air for its operation and weighing very much less its cost is smaller.

Armored Wire Rope

Armored wire rope, Gore construction, is claimed to have a wearing life two or three times greater than similar quality rope of standard construction. In this rope each strand is wound with flat steel wire having convex edges, and forms a protective armor that prevents all exterior abrasive wear on the tensile-strength wires. The flat armoring wires are held transversely to the axis of the rope so that they do not affect its flexibility, and the convex edges of the armoring wire permit the flexing of the rope without any creeping of the armor. This rope is marketed by the Waterbury Co. of 80 South St., New York, as Waterbury armored wire rope, Gore patent. The standard constructions are composed of 6 strands, 19 wires to the strand; 6 strands, 37 wires to each strand; or 6 strands, 61 wires to each strand. The rope may have a hemp or wire center, as conditions demand.

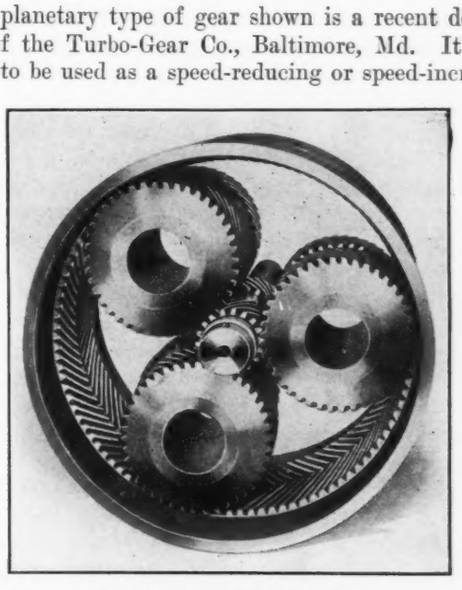
The Waterbury armored rope has been applied to steam-shovel service, dragline excavators, harbor and gold dredges, etc. El Oro Dredging Co., of California, tested some of the Waterbury armored rope in competition with ordinary wire rope and has written the manufacturers as follows:

> We used as a side line on a larger dredge 650 ft. of ⅞-in. high-grade rope from one of the large manufacturers, which cost $123.22, and lasted 183 days. We replaced this with 650 ft. of ¾-in. crucible-steel, Gore construction, steel-clad rope furnished by you at a cost of $82.56. To make the units of service the same for each dollar of cost, your rope should have given us 122 days' service, but at this writing it has been in service 254 days, and we have no present intention of taking it out. In other words, it has already given us twice the service of the other rope for each dollar of cost, and we are not through with it.

The Waterbury Co. also markets a fibre-covered wire rope under the name of Waterbury Fibreclad wire rope. The tarred marline covering protects the wire strands of the rope from moisture and grit, and unlike manila rope is not affected by changes in atmospheric conditions. Hence it neither stretches nor swells and jams in the blocks. It is claimed that it will outwear either bare wire or manila rope. Its strength is said to be greater than that of manila rope of the same size and the weight is 50% less than that of manila rope of the same strength.

Planetary Reduction Gear

The planetary type of gear shown is a recent development of the Turbo-Gear Co., Baltimore, Md. It is designed to be used as a speed-reducing or speed-increasing



TURBO-REDUCTION GEAR

gear and will run either right- or left-hand. The driving and driven shafts rotate in the same direction.

The gear consists of a large internal double-helical gear made of an openhearth steel forging. A double-helical pinion cut integral with the high-speed shaft is made of chrome-vanadium steel. The intermediate double-helical gears are made of manganese-bronze and are

mounted on hardened and ground forged-steel shafts, secured to the slow-speed member.

The slow-speed member, to which is secured the slow-speed shaft, is mounted on two heavy-duty ball bearings, one on each side of the gears, and is supported directly by the heavy housing. Thus, it will be seen that the slow-speed member and the shaft carrying the intermediate gears and the high-speed shaft and pinion are independent of each other for support.

Schoop Metal-Spraying Pistol

In the *Journal* of Mar. 11, 1911, there is a description of an early form of apparatus for mechanically applying a thin coat of metal, the device being known as the Schoop metal-spraying pistol. By its use it is possible to apply a metal coating to other metal surfaces and to many other substances, such as wood, plaster, paper, leather, glass, porcelain and cloth. An important feature, also, is the variety of metals and alloys that can be so applied. The coating may be thick or thin, as desired, and is applicable not only to fine decorative construction, but also for rough work, as coating iron or steel articles with some noncorrosive covering such as lead, zinc, tin or copper.

In a paper read by R. K. Morcom before the Institute of Metals the Schoop process is described as follows:

"The essential parts of the machine, or 'pistol' as it is called, are a combined melting and spraying jet and a feed mechanism. The metal, in the form of rod or wire, is fed to the melting flame. The flame can be formed by coal gas, water gas, acetylene, hydrogen, etc., burning in air or oxygen, according to the metal used. The gases are supplied at such pressures as to prevent blowing out and to insure a highly reducing flame. The spraying jet can be of carbon dioxide, nitrogen, air, steam, etc., the pressure used being necessarily high enough to produce an adhesive coating. To obtain the best adhesion, the surface on which the metal is sprayed must be absolutely clean and of an open nature to give a key for the deposit. Sand-blasting with sharp sand has been found best. Shot give too polished a surface. Such surfaces as fabrics, wood, unglazed earthenware and asbestos require only freedom from grease, as their surfaces give a natural key.

"As at present constructed, the standard pistol uses about 0.55 to 0.6 cu.ft. of air per min. for every 1 lb. per sq.in. air pressure, so that with an air supply at 80 lb. per sq.in., which is a very suitable figure for ordinary spraying, the air consumption will be from 45 to 50 cu.ft. per min. The mass of this will be from 830 to 920 grams, and the mass of metal sprayed by this air will be from about 8 grams in the case of iron to about 200 grams in the case of lead.

"The action of deposition is probably a complex one. The minute particles of solid metal are driven with such force against the object that in some cases they fuse, but, owing to their small relative size, are promptly chilled by the object to which they adhere. If any of the particles are molten or gaseous they will adhere. In addition, the suddenly chilled particles are possibly, or even probably, in the state of unstable equilibrium found in 'Prince Rupert's drops,' and act like so many minute bombs, bursting on impact to almost molecular dimensions.

"The process requires some care in manipulation, as by varying the conditions it is possible to spray porous or nonporous coatings, and with some metals anything from a pure metal to a pure oxide. With care, however, nonporous, oxide-free, adherent coatings can be produced of almost any metal on almost any solid. In addition to metals it is possible to spray fusible nonmetals, or, by stranded wires, alloys of metals or mixture of metals with nonmetals."

The spraying pistol and process are the invention of a Swiss named M. U. Schoop, and while it has been in use in Europe for some time, it has been introduced into the United States only within the last 18 months. The pistol is a portable hand tool weighing about 3½ lb., and is connected by small tubes with reservoirs supplying oxygen, hydrogen and compressed air. The compressed air-blast nozzle is concentric with the oxyhydrogen burner. As the compressed air issues from the pistol it drives a minute turbine, which in turn propels friction wheels that feed the wire into the flame.

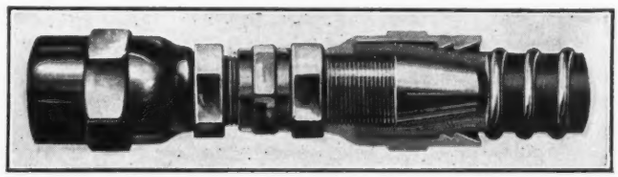
In at least one instance the apparatus is employed in the mining field. Phelps, Dodge & Co. use it at Douglas, Ariz. The purpose for which it is there operated is best described by Lawrence Addicks, formerly of that company, who says under date of Feb. 6, 1915:

"I have been experimenting with several processes for lead-coating materials of construction to protect them from acid liquors. One particular problem has been the coating of the copper connections attached to carbon anodes in the electrolysis of copper in a sulphate electrolyte. The ferric sulphate formed gradually eats away unprotected copper, and it is difficult to devise an all-lead connection.

"A Schoop pistol, furnished by the Metals Coating Co. of America, People's Gas Building, Chicago, Ill., has made coatings of a satisfactory appearance. They have not as yet been tested for durability in service. Our method of anode construction is to electroplate the upper ends of the carbon plates with copper, then to attach the copper terminal strips with copper bolts; next to apply a coat of acid-proof paint; finally to spray a substantial coating of pure lead over the paint."

"National" Hose Coupling

The "National" hose coupling embodies durability and efficiency in attaching a hose to a threaded metal terminal. The principle of the device is distinctive, since it makes no attempt to apply pressure to the outside of the hose,



"NATIONAL" HOSE-COUPLING DEVICE

the whole force being applied from the inside, making it easy to obtain a tight connection.

It is particularly adapted to compressed-air connections on drills, pneumatic tools, and to similar uses. It is made by the National Hose Coupling Co., People's Gas Building, Chicago.

What the Dip Needle Can and Cannot Do

By C. A. Cheney, Jr.*

SYNOPSIS—A series of questions and answers covering the conclusions to be deduced from dip-needle indications. Experience is required both in observing and reasoning. It is not reliable in the hands of the amateur.

In the course of a long experience I have met many so-called "practical" mining men who have expressed themselves as having little faith in the results of magnetic surveys made for the purpose of delimiting iron formation. One went so far as to remark that an old steam gage would indicate the position of an iron-bearing formation as well as would a dip needle.

At the other extreme there are many who are able, from a dip-needle survey, to make marvelous deductions as to the depth of burial, quality of ore, size of orebody and attitude of the strata of the formation. These persons visualize the iron formation as made up of inclined strata with beautifully regular dips and curves, and if necessary, they often unconsciously obtain needle readings which will agree with a preconceived theory as to the attitude of the underlying formation.

Its Value in Iron-Ore Exploration

Between these two extremes are a small number of men who have had the opportunity of following exploration work from prospect to mine and are therefore able to recognize the extent to which it is wise to draw inferences from a magnetic survey. The dip needle is now in greater use than ever before and is invaluable in many ways, but its real limitations are little known. For this reason, answers to some oft-repeated questions are of interest to those engaged in exploration for iron ore.

Do the dip-needle readings furnish any clew as to the depth of burial of the formation?

Observation leads me to assert that in any district in the Lake Superior region the readings do not indicate, even in a most general way, the distance of the formation below the surface. It follows that the differences of elevation in any district probably are not great enough to cause any relative variations in the amount of magnetic dip. As evidence I can cite the following cases: A maximum magnetic dip of 40° on a Vermilion Range outcrop of iron formation; a maximum magnetic dip of 40° on a possible southwestern extension of the Vermilion Range at a point where drilling subsequently proved the depth of surface to be 450 ft. In another district the maximum reading was 35° at a point where geological considerations indicate that the formation causing the magnetic dip is at least 1200 ft. below the surface. In this same district maximum magnetic readings actually grow less with decrease in thickness of overburden.

Enough other cases might be cited to prove conclusively that in any Lake Superior district the relative variations in the amount of magnetic dip are not indicative of variations in depth of overburden. In instances where geologists have considered the dying out of the magnetic indications as indicative of an increasing depth of overburden, the real reasons are, probably, that the iron formation has "petered out" or if present that it was originally less metamorphosed than the adjoining portion and consequently is so thoroughly altered to the nonmagnetic oxides as to cause no variations of the magnetic needle.

Quality of Ore Not Determinable

Do the magnetic readings furnish any evidence as to the quality of the ore?

In only two mines in the Lake Superior region is magnetite mined as a magnetic ore. Practically all of the ore produced in the region is composed of hematite, limonite and other nonmagnetic oxides.

The magnetic field encountered in crossing most iron formations is therefore ordinarily not caused by the ore, but by the associated magnetic slates, which may be the hanging wall, foot wall or bottom of an orebody, or may not be associated with any ore. There may be enough disseminated magnetite in some ores to influence slightly the needle, but where magnetic slates are present the relative amount of this pull would be very small.

The almost completely altered and productive formation of the central Mesabi district exerts but a small pull on the magnetic needle, but in an adjoining district a similar small magnetic attraction is frequently found to be due to a little-altered and unproductive formation. On the other hand, high magnetic readings of equal value have frequently been found, caused in one case by a richly productive iron formation and in another case by an absolutely barren iron formation.

From these considerations it is evident that it is unwise to estimate the probable quality of the ore by means of the dip-needle readings.

Do the readings indicate the size of the orebodies?

No, for reasons that have already been enumerated. In practically all cases, however, the area of the magnetic field is directly proportional to the area of a horizontal plane passing through the top of the iron formation. That is, a wide area of magnetic attraction is representative of a wide area of iron formation, and vice versa. Examples are so plentiful that this fact is universally recognized.

Maximum Magnetic Line

Does the maximum magnetic line overlie the iron formation?

Most exploration work is conducted on the theory that the maximum magnetic line overlies the iron formation. In general it does, but frequently it does not. There are numerous cases where the maximum magnetic line sometimes lies completely outside of the boundary of the iron formation as projected vertically to the surface.

*Geologist, Madison, Wis.

On the Cuyuna range the distance of the maximum magnetic line outside the vertically projected boundary of the iron formation is in some cases over 100 ft. Furthermore, in the same district the maximum magnetic line occasionally crosses the strike of the iron formation at small angles. Because of these conditions, in that district at least, the drilling should not be confined too closely to the locus of the maximum magnetic readings. It has been common practice to do this and as a result some properties have been condemned before all exploration possibilities have been exhausted.

Character of Magnetic Readings Differs with Sedimentary and Igneous Rock

Does the character of the magnetic readings indicate whether the attraction is caused by a sedimentary iron formation or by a basic igneous rock?

In general, yes. One who has done much work with the dip needle can usually recognize the freakish character of the magnetic dips caused by other material than the type iron formation.

My experience has been that massive basic segregations in igneous rocks almost invariably attract the south end of the needle, whereas the sedimentary iron formations attract the north end. Sometimes these magnetic areas are in many respects similar to magnetic areas caused by a sedimentary iron formation, the difference being that a different end of the needle is attracted in one case or the other.

Negative readings—attraction of south end of needle—are also obtained in many cases along formation boundaries, usually the contact of a slate and an igneous rock.

In some instances positive readings are due to the presence of magnetite in greenstone schists. These dips may be recognized by their erratic character. The maximum readings in general are not related on adjacent cross-sections and die out rapidly in a transverse direction.

Is it possible to determine the dip of the formation from the magnetic readings?

Deductions derived from dip-needle readings as to the attitude of the formation seldom "pan out" right, and when they do it is probably largely a case of coincidence. Where the variations of magnetic dip are uniformly similar on several cross-sections and where the differences in variation of magnetic dip are marked, they may give a real clew as to the dip of the formation. Any theories based on small variations are, however, very apt to be exploded when the formation becomes known by drilling.

In spite of the limitations of the dip needle, I doubt if any other invention has made or saved so much money in proportion to its cost, for men engaged in search of iron formation. It is an undeniable fact that an iron formation can be located and traced by means of a dip needle, and this is always the prime reason for such a survey.

Furthermore, the knack of taking correct dip-needle readings can only be obtained by much experience with the little instrument in several districts. The work looks extremely simple and I have heard many say, "There's nothing to it, I can do it," but these persons are in the same class with those who think that they can "guess which shell the little pea is under."

Bureau of Mines Radium Production

The production of radium from Colorado carnotite ores by the Bureau of Mines, in connection with the National Radium Institute, has passed the experimental stage in its new process and is now on a successful manufacturing basis, according to an announcement made on July 27 by Secretary of the Interior Franklin K. Lane. He also declared that the statements made to Congress concerning the ability of the Bureau of Mines to produce radium at a greatly decreased cost over that of other processes had been substantiated.

The cost of one gram of radium metal produced in the form of bromide during March, April and May of the present year was $36,050. The cost of producing radium in the small experimental plant during the first few months of the Bureau's activities was somewhat higher, but not enough to affect seriously the final average.

It should not be inferred, however, that this low cost of production necessarily means an immediate drop in the selling price of radium. The National Radium Institute was fortunate in securing through the Crucible Steel Co. the right to mine on 10 claims of carnotite ores belonging to it, and this was practically the only ore available at the time. Since then new deposits have been opened, but these are closely held; and according to the best judgment of the experts employed by the Bureau of Mines, the Colorado and Utah fields, which are much richer in radium ores than any others known, will supply ore for a few years only at the rate of production that obtained when the European war closed foreign mines. The demand for radium will also increase rapidly.

The 10 carnotite claims being operated at Long Park, Colo., by the National Radium Institute have already produced more than 796 tons of ore averaging over 2% U_3O_8. The cost of ore delivered at the radium plant in Denver has averaged $81.30 per ton. This included 15% royalty, salary of the Bureau of Mines employees, amortization of camp and equipment and all expenses incident to the mining, transportation, grinding and sampling of the ore.

A concentrating plant for low-grade ores has been erected at the mines and is successfully recovering material formerly wasted. The radium plant at Denver has now a capacity of three tons of ore per day, having been more than doubled in size since last February. Before that time the plant had been run more or less on an experimental scale, although regularly producing radium since June, 1914. To July 1, 1915, slightly over 3 grams of radium metal were obtained in the form of radium-barium sulphate containing over 1 mg. of Ra per kg. of sulphates. The conversion of the sulphates into chlorides and the purification of the radium therefrom are easily accomplished, and with small loss of material. Unfortunately, however, acid-proof enamel ware, obtainable only in France, has not been delivered of sufficient capacity to handle the crystallization of the full plant production, so that only 1304 mg. of radium have been delivered to the two hospitals connected with the National Radium Institute. The remaining radium can be crystallized at any time from neutral solution in apparatus already installed. But the greater rapidity and efficiency of production of this valuable material by the methods

used have decided the Bureau of Mines to await the completion of apparatus now being built before pushing the chloride crystallization to full capacity.

The average radium extraction of all ore mined by the National Radium Institute has been more than 85% of the amount present in the ore, and for the last five carloads of carnotite treated, above 90%.

War Affects the Manganese Industry

The production of manganese ores in the United States in 1914 amounted to 2635 long tons, which was 1413 tons less than the output of 1913, according to the Geological Survey. The manganese ore shipped in 1914 was derived from mines in Virginia, South Carolina and California. The domestic output was small compared with the imports of manganese ores, which amounted in 1913 to 345,090 long tons and in 1914 to 283,294 long tons.

India, Russia and Brazil have been the principal countries from which manganese ore has been imported. In 1913 the largest imports were from India, amounting to 141,587 tons, and the imports from Russia were 124,337 tons. The closing of the Dardanelles, and probably the scarcity of vessels for transportation from India in 1914, had the effect of reducing the imports from Russia to 52,681 tons and those from India to 103,583 tons. These decreases were partly compensated for by the increased shipments from Brazil, which were 70,200 tons in 1913 and 113,924 tons in 1914.

The output of all grades of manganiferous ores in 1914 was 445,827 long tons (mainly from the Lake Superior region), of which 60,414 tons contained more than 15% of manganese and was used in the manufacture of low-grade ferromanganese and manganiferous pig iron.

The marketed domestic production of ferromanganese in 1914 was 100,731 long tons and the imports of ferromanganese were 82,997 long tons. The marketed domestic production of spiegeleisen decreased from 106,980 long tons in 1913 to 76,625 tons in 1914, and the imports increased from 77 tons in 1913 to 2870 tons in 1914. The larger part of the spiegeleisen was made from manganiferous zinc residuum derived from New Jersey mixed manganese and zinc ores, though for the first time since 1909 spiegeleisen was produced from the manganiferous ores of Leadville.

As heretofore, practically all the domestic output of ferromanganese was made from imported ores, though some medium-grade ferromanganese was made from manganiferous iron ores of the Cuyuna Range in Minnesota at the Dunbar furnace in Pennsylvania.

If the domestic production of steel and steel products increases considerably on account of the temporary elimination of competition from European steel products, the sources of manganese supply may be abnormally taxed to meet the demand. The increased price, however, will stimulate domestic production and permit the mining of manganese ores which, under normal conditions, could not be profitably worked.

[The situation at the present time has aroused interest in the manganese ores of Virginia, and several of the deposits in the southwestern part of that state are being investigated.—Editor.]

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALUMINUM ALLOY. William A. McAdams, Bay Shore, N. Y. (U. S. No. 1,146,185; July 13, 1915.)

BRIQUETS — Binding Means for Briquets. Wilhelm Schumacher, Osnabrück, Germany. (U. S. No. 1,146,455; July 13, 1915.)

CONCENTRATOR—Ore Concentrator. Fritz Oscar Stromborg, Salt Lake City, Utah. (U. S. No. 1,146,211; July 13, 1915.)

CRUSHER. Thomas L. Smith, Milwaukee, Wis. (U. S. No. 1,145,929; July 13, 1915.)

CRUSHERS—Lubricating Device for Gyratory Crushers. Richard Bernhard and Jacob M. Sholl, Milwaukee, Wis., assignors to Power & Mining Machinery Co. (U. S. No. 1,145,967; July 13, 1915.)

DRILLING—Air and Water Blowpipe for Rock Drilling. Frank T. Sanders, Colorado Springs, Colo., assignor of one-half to Owen Dodge, Colorado Springs, Colo. (U. S. No. 1,146,284; July 13, 1915.)

DRILLS—Feeding Means of Percussive Rock-Drills, Coal-Cutters, and the Like. Frank Simon and John William Scott, Minnaar, Transvaal, South Africa. (U. S. No. 1,146,356; July 13, 1915.)

EXTRACTION—Composition and Process for Extracting Precious Metals from their Ores. James F. Williams, San Francisco, Calif. (U. S. No. 1,145,954; July 13, 1915.)

FILTERING APPARATUS. William E. Holderman, Salt Lake City. (U. S. No. 1,146,256; July 13, 1915.)

FLOTATION—Concentration of Minerals by Flotation. Archibald R. Livingston, Cañon City, Colo., assignor to the New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,147,633; July 20, 1915.)

GRAPHITE—Process for Converting Coke into Graphite. H. Plauson. St. Petersburg, Russia. (Brit. No. 17,732 of 1913.)

PHOSPHATE—Fertilizer Composition and Process of Making It. Thomas Leopold Willson and Maximilian Mattheus Haff, Ottawa, Ont., Canada, assignors, by direct and mesne assignments, to Southern Investment Co. of Canada, Ltd., Montreal, Canada. (U. S. No. 1,145,107; July 6, 1915.)

PIG IRON—Process for Dephosphorizing Pig Iron. Amand Francois Pasquier, Dijon, France. (U. S. No. 1,145,506; July 6, 1915.)

POTASH—Process of Making Potash and Structural Materials and Products Thereof. Arthur C. Spencer, Washington, D. C. (U. S. No. 1,146,532; July 13, 1915.)

PUMPS—Balancing Means for Centrifugal Pumps. Ferdinand W. Krogh, San Francisco, Calif. (U. S. No. 1,146,078; July 13, 1915.)

REHEATING FURNACES—Improvements in or Relating to Reheating Furnaces. Eickworth & Sturm Ges. mit Beschrankter Haftung, Dortmund, Germany. (Brit. No. 5875 of 1915.)

ROASTING—Ore-Roasting Furnace. Irven R. Margetts and Earl R. Pembroke, Salt Lake City, Utah. (U. S. No. 1,145,329; July 6, 1915.)

SCREEN or Separator. Thomas Joseph Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co. (U. S. No. 1,141,988; June 8, 1915.)

SEPARATOR—Magnetic Separator. Francis B. Dutton and Benjamin E. McKechnie, Lebanon, Penn., assignors to Pennsylvania Steel Co., Philadelphia, Penn. (U. S. No. 1,146,141; July 13, 1915.)

SIEMENS-MARTIN FURNACES—Improvements in or Relating to Siemens-Martin Furnaces. Eickworth & Sturm Ges. mit Beschrankter Haftung, Dortmund, Germany. (Brit. No. 5651 of 1914.)

SKIMMING LADLE. Jesse L. Jones, Wilkinsburg, Penn., assignor to George L. Curtiss Co., Pittsburgh, Penn. (U. S. No. 1,145,422; July 6, 1915.)

SLAG STEAM GENERATOR. Leonce L. Battu, New York, N. Y., assignor to Slag Steam Generator Co., New York, N. Y. (U. S. No. 1,145,178; July 6, 1915.)

SMELTING FURNACE. Pierre Plantinga, Cleveland, Ohio. (U. S. No. 1,146,097; July 13, 1915.)

SMELTING FURNACES — Reversing Valve of Gas-Fired Smelting Furnaces and the Like. Evan Lewis, Swansea, Wales. (U. S. No. 1,146,582; July 13, 1915.)

SMOKE—Cooler-Flue and Hopper for Fume-Arresting Apparatus. Alfred U. Field, Redding, Calif. (U. S. No. 1,146,319; July 13, 1915.)

SULPHUR SMOKE—Recovery of Sulphur Dioxide. James B. Garner, Pittsburgh, Penn., assignor to Metals Research Co., New York, N. Y. (U. S. No. 1,145,579; July 6, 1915.)

SULPHURIC ACID—An Improved Apparatus for Concentrating Sulphuric or Other Acids. P. L. Pfannenschmidt, Thornhill, Leeds, and Richard Moss, Dewsbury, Eng. (Brit. No. 13,642 of 1914.)

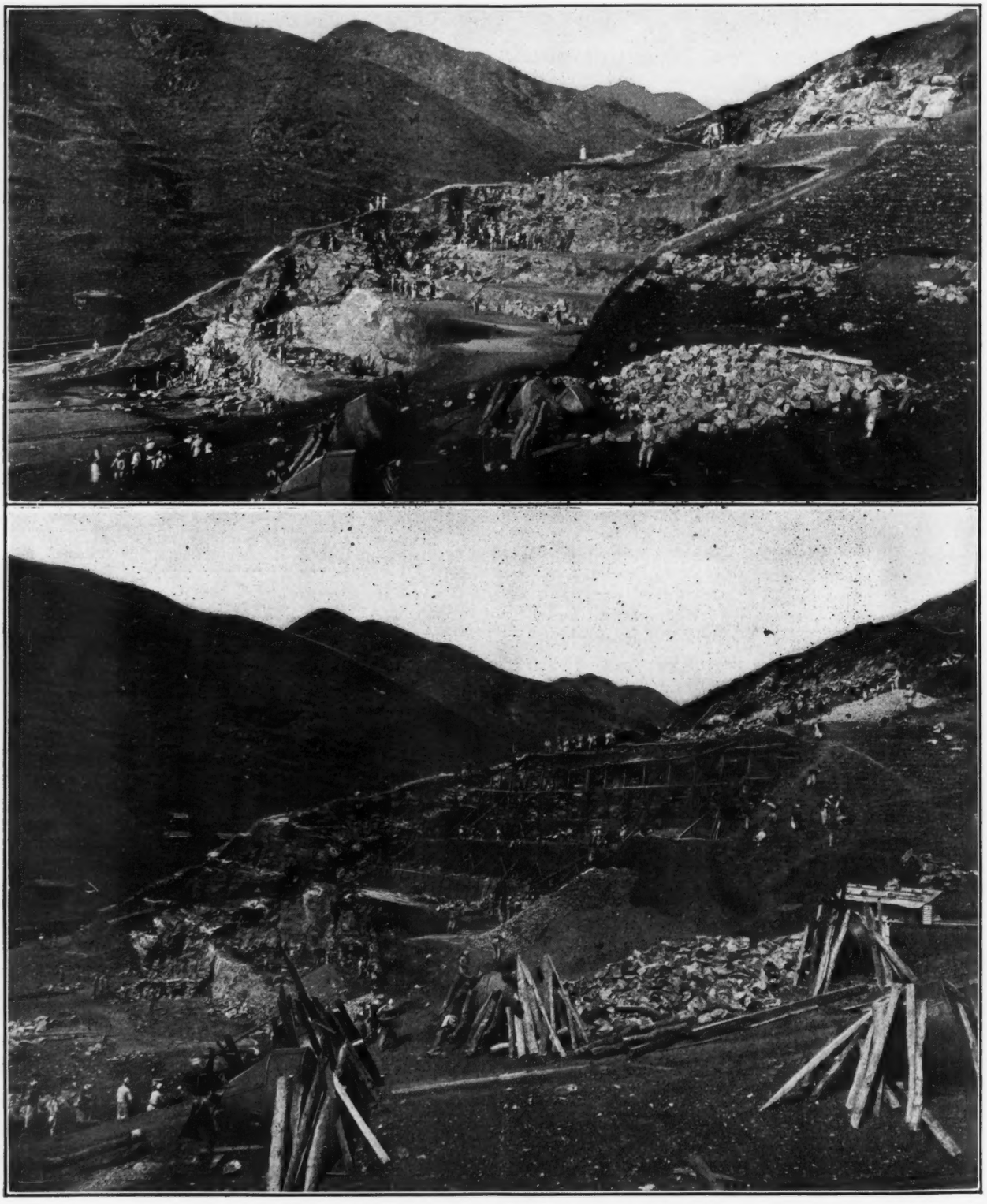
TUBE MILL. Guy C. Howard, Everett, Wash. (U. S. No. 1,146,760; July 13, 1915.)

TUNNELING MACHINE. Dighton A. Robinson, Seattle, Wash. (U. S. No. 1,146,281; July 13, 1915.)

ZINC—Process of Treating Zinc-Bearing Materials. Woolsey McA. Johnson, Hartford, Conn., assignor to Continuous Zinc Furnace Co., Hartford, Conn. (U. S. No. 1,146,075; July 13, 1915.)

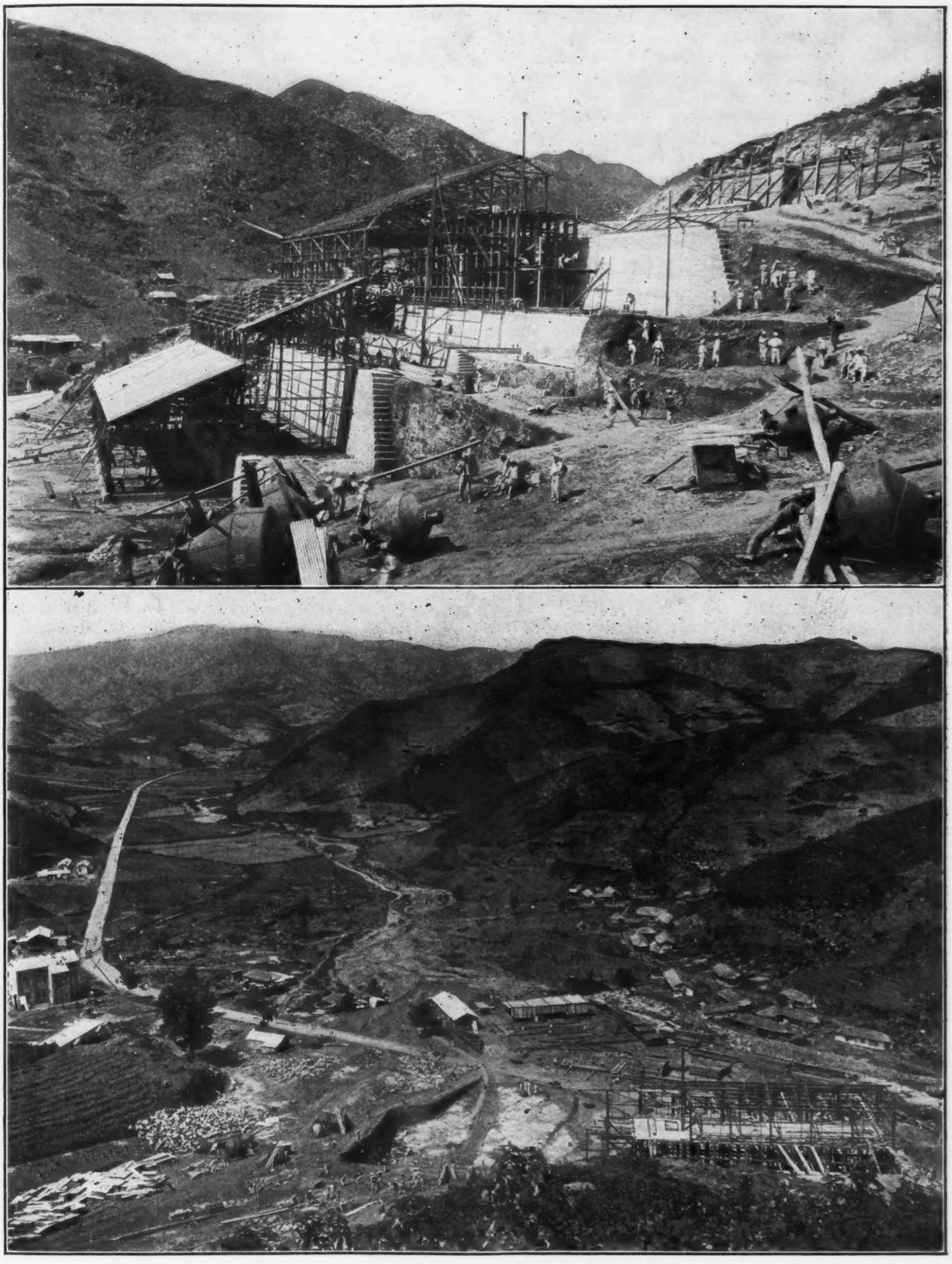
ZINC—Process for the Treatment of Zinkiferous Materials. H. Specketer, Griesheim-on-the-Main, Germany. (Brit. No. 20,039 of 1913.)

Photographs from the Field



SEOUL MINING CO.'S PROPERTY, HOLKOL, CHOSEN

Upper view shows grading operations in progress at the site of the new Tul Mi Chung mill. Lower view shows the placing of the concrete retaining walls and foundations



SEOUL MINING CO.'S PROPERTY, HOLKOL, CHOSEN

In the upper view is shown the rapidly advancing mill construction with much of the machinery on the ground. In the lower view, taken from above the Tul Mi Chung millsite, is shown the mill under construction and a perspective of the surrounding country

Editorials

The Birth of a Myth

Those who want to take the trouble may witness the development of a myth from its beginning. This is the belief, already held more or less extensively in Great Britain and Canada, that the American zinc-smelting industry is controlled by Germans, that they boosted the price for spelter to four or five times the normal in order to penalize their enemies and thus carry on warfare in one way if they could not in another. Nothing could be any more ridiculous or contrary to patent facts, yet without any doubt this myth will live and grow. Merely for the sake of the accuracy of the records, however, it is worth while to state the facts. Here they are: The zinc smelters of the United States, together with the number of their retorts, are listed annually. Their relative importance and their producing capacity are about in proportion to the number of their retorts. On Jan. 1, 1915, the total number of retorts in American zinc-smelting works was about 120,000. The firm of Beer, Sondheimer & Co., of Frankfurt-am-Main, has a New York agency, and is interested in the National Zinc Co., which possesses two smelteries with an aggregate of about 7500 retorts. The American Metal Co. is an American corporation, whereof numerous of its important officers are American born, but it is no doubt affiliated with the Metallgesellschaft, of Frankfurt-am-Main. The American Metal Co. owns and controls the Bartlesville Zinc Co., the Lanyon Starr Spelter Co., and the American Zinc & Chemical Co., which possess four smelteries with an aggregate of about 17,500 retorts. Consequently, these interests at the beginning of this year had an aggregate of about 25,000 retorts, a trifle more than 20% of the American total.

We are not intimating that these concerns, either of them or both of them, ever had any idea of playing tricks upon the buyers for the Allies, but are stating the plain fact that the control of the zinc-smelting industry has never been centered in any one quarter. It always has been, and still is, divided among a good many independent interests. The other big interests in the business are: The American Zinc, Lead & Smelting Co. (of Boston), the Edgar Zinc Co. (U. S. Steel Corporation), the Granby Mining & Smelting Co. (of St. Louis), the Grasselli Chemical Co. (of Cleveland), the Hegeler Zinc Co., Illinois Zinc Co., and Matthiessen & Hegeler Zinc Co. (of Illinois), the New Jersey Zinc Co. (of New York), and the United States Zinc Co. (a subsidiary of the American Smelting & Refining Co.). Recently, the United States Smelting, Refining & Mining Co. (of Boston) bought three old works and entered the business. The pedigrees of these concerns are so well known that no restatement of them is necessary.

The British must look nearer home to find out why the price for spelter was rushed upward so extravagantly. They will find a large part of the explanation in their own policy of "muddling along." Among other exhibitions of the muddling that may be mentioned are the unnecessary refinement in the spelter specifications and the farming out of ammunition contracts in ways that caused buyers in the same ultimate interest to appear as competitors of each other and to figure as being in the market for a great deal more spelter than was really the case. As an exhibition of ignorance, muddled with stupidity, the buying of spelter during the second quarter of 1915 was preëminent; nor does any great light appear yet to have burst through the shells inclosing the official minds.

The Recession in Copper

There is now a good deal of talk in the newspapers about the greatly increased production of copper, the greatly diminished exportation as compared with corresponding periods of 1914, and the recession in the price of the metal. In the absence of any statistics the trade is now in the dark respecting the actual rate of production. However, there is no doubt that the present production is very large, perhaps the largest on record so far as the United States is concerned, inasmuch as all of the important mines are being operated as strenuously as can be done. Nor is there any doubt that the exportation of refined copper in bars, cakes and ingots is less than it used to be, for there are definite statistics upon that subject. However, those statistics do not give the quantity of copper exported in the form of brass and other manufactures, which exportation has lately increased enormously. It is well known that the brass makers of Connecticut are working overtime.

With respect to the recession in price, the previous exaggeration of the Wall Street papers is now coming home to roost. The copper market did not at any time rise to 20½c. The high point was 20¼c., regular terms, which corresponds to a trifle more than 20c. cash, New York, the customary discount of ½ per cent. amounting to 10 points, while the average freight rate on deliveries is probably in the neighborhood of 10 points, making a total of 20 points. Some sellers reckon the average cost of delivery a little lower, while others reckon the total differential a little higher, there being usually a loss of interest of about 15 days in addition to the regular allowance of 30 days. Therefore the price of copper has declined from the level of about 20c., not 20½c.

The decline started immediately after the cessation of the great buying movement about the middle of June. The principal producers were then sold well ahead, and, being busy with their deliveries, they were more or less indifferent as to whether buyers wanted to contract immediately for more copper or not. On the other hand, there are interests that contractually have to take in copper all the time and must either accumulate it at the expense of capital or credit, or must sell it for what they can get. There are numerous small producers of crude copper who are confronted by the same conditions. The

recent recession in the price for copper has come about naturally through the efforts of such interests to find a level upon which the metal would move. There has been no pressure on the market and the inauguration of a new buying movement of important dimensions would no doubt lead to a sharp rally.

Indeed the situation of copper appears to be fundamentally strong. In spite of the increased production, the refiners agree that the stocks in their hands have not increased. The consumption of copper for ammunition will continue to be large, but most important is probably the coming increase in domestic, peaceful, consumption which the revival in the iron and steel industry—now a well-established fact—is believed to foreshadow.

Tin Smelting in the United States

According to British reports, a well-known metallurgical corporation—Williams, Harvey & Co., Ltd., of Bootle—has informed its Bolivian clients by circular that it is establishing a modern tin-smelting works on an appropriate site in the United States for dealing with Bolvian *barrilla*. Other reports have associated this statement with the plan of the American Smelting & Refining Co., previously announced. We are authorized by a high officer of the latter company to state that its tin-smelting enterprise is in all respects an independent one. We have been unable to learn definitely respecting the plans of Williams, Harvey & Co.

The American Smelting & Refining Co. is making excellent progress with its plant near Perth Amboy. It expects to be able to begin the refining of tin before the end of the fall, and it hopes that the whole of the plant will be in operation by the middle of the winter.

The Directorship of the Bureau of Mines

A matter of great concern to the mining industry is the appointment of a director for the Bureau of Mines in succession to Dr. Holmes. A good man in that important position can be very helpful to the mining industry; a bad man can be very harmful; a mediocre man may be neither the one nor the other, but may be simply the holder of a job. According to all accounts, the job-hunters are already out in great force, and also there are prevalent some queer ideas as to what constitutes the proper qualifications for a director of the Bureau of Mines.

A Washington paper that has come to our attention tells of some conference that occurred in Philadelphia, and concluded its story with this paragraph:

> Among other names discussed at the conference either with the indorsement of one or more of the conferees or presented at the suggestion of friends were: Sheriff A. Lincoln Acker, E. T. Stotesbury, Charlemagne Tower, Justice Robert Von Moschisker of the Supreme Court, Common Pleas Judges Charles Y. Audenried and J. Willis Martin; William T. Tilden, former president of the Union League; Louis J. Kolb, Attorney-General Francis Shunk Brown and Assistant District Attorney William Findlay Brown.

No, readers in the mining districts, East and West, we do not think that this was intended as a joke. In the minds of many persons a sheriff of a county, or an assistant district attorney, would be just as competent as the director of the Bureau of Mines as any mining engineer, mine operator, or mining scientist. Nor is it a humorous suggestion that the appointment may fall to some mining walking-delegate. In the appointment of the directors of the Census and of the Mint the experts were passed by, and we must make up our minds to the chance that the same disagreeable thing may happen with respect to the directorship of the Bureau of Mines.

It is the hope of the *Journal* that the President will appoint to this important position a man of high professional attainments and great distinction in the mining industry. We pray that the President will thus limit his choice.

A Reported Steel Combination

A Cleveland correspondent, apparently of an imaginative turn, last week sent out a dispatch announcing the preliminary organization of a new combination to rival the Steel Corporation. According to his statement the new concern was to include the Bethlehem, the Jones & Laughlin, the Cambria, the Pennsylvania, the Lackawanna Steel companies and the Colorado Fuel & Iron Co., together with several minor companies and probably the Republic Iron & Steel Co. In brief, it was to include all the prominent independent steel makers and as many of the smaller concerns as one might care to mention. The new combination was to be headed by Charles M. Schwab as manager and Henry C. Frick as financier.

The publication of the statement was met by a chorus of denials from all the parties concerned. It is claimed that, so far from such a combination being partly organized, it was not even contemplated or considered by the parties chiefly in interest; and that the larger independent concerns had no idea of giving up their individuality or of becoming members of a new combine. So far as can be judged these denials are sincere, and no one now has it seriously in mind to organize a new combination.

Somewhat similar rumors have been circulated before, but the formation of new combinations would hardly be considered while the Government suit to dissolve the Steel Corporation was pending. The recent decision in that suit might be thought to open the way for further amalgamations, but the time for floating such consolidations as those of 15 or 20 years ago is past. To say nothing of the difficulty of floating the great mass of securities required, public opinion on corporations has materially changed since 1900, and there would be strong and natural suspicion of an attempt to divide the steel trade between two great corporations.

It is quite possible that there may be some consolidations and combinations, but nothing on the scale of the Cleveland rumor is probable. Nor are all steelmen satisfied that the great combination is the wisest and most economical. Certainly it is not desirable from a technical point of view; a great corporation is not usually favorable to change or progress.

An interesting development in the mining industry that heretofore has escaped general attention is the fact that the Bawdwin mine of Burma is already producing. During the first six months of 1915 they are officially

reported as having produced 6500 long tons of lead, which is a very respectable output. An increase in the lead production of this great mine is to be expected later, when plans for the utilization of the zinc content and other metals of its ore shall have been consummated.

BY THE WAY

When it comes to handling a "real-estate proposition" apply to the Department of the Interior. Ninety days ago the town of Anchorage, Alaska, was merely public land at the southwestern terminus of the new Government railroad. Now it has a population of over 2500, and nearly all branches of business are represented. On July 15 an auction sale of lots was held by the Alaskan Engineering Commission, and Chairman Edes telegraphed Secretary Lane the next day as follows: "Just returned from Anchorage. Sale in every way a success and everyone satisfied. About four hundred and fifty lots sold for one hundred thirty-three thousand dollars." Nearly $300 a lot was thus realized. Most of the lots were 60x140 ft., and streets, parkings and playgrounds were provided. Watch Alaska grow!

Never argue with an expert. It is useless. There is no way of making headway against him. Though you may know much more than he does, you can't possibly get him to admit it. His main defense lies in the possession of his own special vernacular. No expert, says *Life,* is complete without a vernacular. Many experts have nothing more. In arguing with an expert, he always begins by assuming: (1) that you don't know what you are talking about, and (2) that if you did know what you were talking about, you couldn't talk about it intelligently, because you lacked the specific vocabulary that the subject demands. As the argument proceeds he spends so much time asking: "Just what do you mean when you use the word —?" And you spend so much time explaining your terms that you totally forget what you are arguing about.

Two German ex-soldiers, Emil Propelle and August Tischer, brought into this country last year two packages of uncut diamonds from German Southwest Africa. They did not declare the stones when they landed here and were later arrested on a charge of smuggling. While doing military duty in Africa, they said they had grubstaked an old prospector who gave them the rough stones, now valued at $57,496, as their share. The ex-soldiers were tried and acquitted of the smuggling charge, but the German Government alleged that the diamonds were taken from the Colonial Mining Co.'s sorting department, and civil suits were brought. Since the war the German Government ceased its action, and yesterday Judge Hand ordered the litigation discontinued. Propelle and Tischer will now be allowed to keep the diamonds on paying $8000 customs duties.

The Similkameen Consolidated Copper Co., of Scranton, Penn., is circulating a prospectus about a group of copper mines at Voigt's Camp, near Princeton, B. C. In a quotation from a report on the property by J. C. Law it is said: "By process of computation, this area, reduced to square and cubic feet to the average depth of 500 ft. only, from which I deduct 70% as unmineralized (probably nearer 50%), resolves itself roughly into 815,000,000 tons of ore. Assuming that only 1½% of coarse copper is recoverable therefrom . . ." Continuation, in the familiar way. If the estimate of tonnage be anywhere near correct, Voigt's Camp has Chuquicamata "skinned to death" and Utah is merely an "also ran." But we're from Missouri.

Scientists have their troubles as well as ordinary people. Edward Hicks, a night geologist, according to the *Tribune,* was arrested on Long Island recently on a charge of chicken stealing. Hicks is a negro and found the night light most appropriate for his complexion and occupation. Here is the address to the court by which Hicks gained his release: "Jedge, youah honah, Ah wants to ask you, sah, did you evah heah of a night geologist? Dat's what Ah am, sah. And, jedge, youah honah, Ah wants to ask you, sah, did you evah heah of a scientific gem'man bein' 'cused of chicken stealin'? Jedge, youah honah, dey's not 'nuff words in all de langwidges to give expressin' to mah indignation, sah! Dis charge am mos' humilitin' to a membah of dat honorable prefession of night geologists of which, sah, Ah have de honah of bein' a humble and undistinguished membah." He showed his outfit, consisting of a lensless telescope barrel, being a "blind telescope" to locate rocks, a rock-tapping device and a textbook on rock composition. The court discharged him with the admonition hereafter to keep away from Plymouth Rocks in his geological researches.

The deepest gold mine in the world, the St. John del Rey in Brazil, is also one of the oldest. It has just paid a dividend of 1s. 3d. on its ordinary share capital, which makes a total of 10% for a year. The company earned more than 10%, but did not deem it desirable to pay a larger dividend at present. The reasons, explained Chairman Harris at the annual meeting of shareholders in London, were connected with the great object that they all had in view, namely, the prolongation of the life of the mine below Horizon 20, which meant that they would be working the mine at a depth greater than $1\frac{1}{10}$ miles under the surface. They were now working the lode at Horizon 18, Shaft G had been sunk to the level of Horizon 20, and crosscuts were being driven from the shaft to intercept the lode at Horizon 19 and Horizon 20. The time was therefore approaching when they would have to decide whether they should or should not take the necessary measures for working the lode below Horizon 20. Their decision would depend upon several factors, the most important of which were the size and value of the lode at Horizon 20. If the lode was as good as it was at the lowest horizon they were now working—Nos. 17 and 18—they would be encouraged to proceed. In regard to the ventilation of the mine, General Manager Chalmers had suggested that the air which was passed through the mine for the purpose of ventilation should first of all be cooled and dried, and then distributed through the workings. If the mine is to be extended below Horizon 20, considerable capital expenditure will be necessary.

PERSONALS

Howard W. DuBois, of Philadelphia, is in Alaska.

W. D. Pearce is in New York from Chihuahua, Mexico.

W. C. Weisbrod is expected in New York Aug. 10, on his return from Chile.

E. R. Eaton, of Greeneville, Tenn., is stopping at Crown Point, N. Y., for the present.

C. E. Drayer has been chosen secretary of the Cleveland Engineering Society, of Cleveland, Ohio.

C. A. Burdick has returned to New York from some professional work in the Province of Quebec.

Kirby Thomas has returned to New York from exploration work in the southwestern part of Virginia.

Dan C. Tobin, of Colorado, is in New York on business connected with the sale of the Midland mine.

E. O. Daue has severed his connection as manager of the Dolores Mines Co. at Madera, Chihuahua, Mex.

Clyde M. Pearce announces the opening of an office as mining engineer at Ironton, Minn., on the Cuyuna Range.

Prof. J. C. Gwillim, of Queen's University, Kingston, Ont., has been on a visit of inspection to the Porcupine camp.

John A. Rice, manager of the Curry mine, at South Lorrain, Ont., has gone to El Paso, Tex., on a short vacation.

A. R. Whitman, lately geologist of the McIntyre Co., has been engaged by the Peterson Lake Mining Co. to examine its property.

W. J. Dobbins, formerly superintendent of the Buffalo mill, Cobalt, Ont., who has been for some time in Florida, has returned to Ontario.

Dr. R. W. Brock, dean of the College of Applied Science, University of British Columbia, has returned to Vancouver from a trip to the East.

E. A. Ling, who has been for some time engaged on an asbestos property near Broughton, Quebec, has gone to South America for the National City Bank of New York.

George E. Farish is making a geological examination of the southern part of Rio Arriba County, New Mexico, for New York mining interests. He is assisted by H. Palsgrove.

Gerald Sherman, general superintendent of the mine department of the Copper Queen Consolidated, of Bisbee, Ariz., was a recent visitor at the Panama-Pacific International Exposition.

L. S. Blackman, who returned to the United States recently from Guanajuato, Mex., sailed on July 24 for Chile, having accepted an engagement with the Chile Exploration Co. at Chuquicamata.

E. Steidel, in charge of the Bureau of Mines mine exhibit and first-aid and rescue demonstrations at the Panama-Pacific International Exposition, has been advanced by the bureau from the position of junior to mining engineer.

M. F. Ortin, Minister of Commerce and Labor in Russia, recently visited the La Grange hydraulic mine in Trinity County, California, the largest hydraulic mine in the world. He was desirous of familiarizing himself with American hydraulic methods.

Dr. E. A. Schubert, of the commercial department of the Norfolk & Western R.R., has been investigating some iron deposits in Ashe County, N. C. The extension of the Virginia-Carolina R.R., now in progress, will furnish transportation for these deposits.

W. T. Partridge, who has had editorial charge of the iron and steel and metal market news of the "Journal of Commerce," New York, has resigned after a connection of a number of years, to devote himself to general writing in the lines in which he is well informed.

George W. Metcalfe, general manager of the Mammoth Copper Co., Kennett, Calif., has recently been a visitor to the Panama-Pacific Exposition, where he has installed a glass model of the Mammoth mine. This model is in the California exhibit in the Mines and Metallurgy Building, which was established by the State Mining Bureau.

M. S. Brandt has severed his connection with the Seneca Consolidated Gold Mines Co. and is returning to Boulder, Colo., where he will resume work for the White Eagle Mining & Smelting Co. He will also open an office for general mining work and will continue his operation of the Nil Desperandum mine on his own account.

Colonel Thomas Cantley, second vice-president and general manager of the Nova Scotia Steel & Coal Co., has been appointed president, retaining the managership. The offices of first and second vice-presidents have been abolished. Governor J. D. McGregor, of Halifax, late first vice-president, and W. D. Ross, of Toronto, are made vice-presidents, Mr. Ross being constituted head of the financial department.

SOCIETIES

American Iron & Steel Institute—The fall meeting will be held at Cleveland, Ohio, Oct. 22 and 23, according to a decision of the directors at New York, June 25.

Arizona State Bureau of Mines—The formation of this body was authorized by the Legislature of the state at its last session and the appointment of the members has been announced by the Board of Regents of the University of Arizona. The director is Charles F. Willis, who has been for two years past director of the University Bureau of Mines, which has been merged with the new organization. The secretary of the Board is Miss A. M. Heckman, who was secretary of the University Bureau. The other members are E. K. Goettel late of the University of Illinois, V. A. Gleason, late of the University of Washington and J. D. Arozena, of the University of Arizona. Mr. Goettel will have special charge of the investigation of the rare metals; Mr. Gleason is a specialist in flotation and ore dressing and Mr. Arozena will have charge of assaying, mineralogical determinations and ore testing.

American Institute of Metals—Among the papers to be read at the annual meeting in September are the following: D. H. Newland, assistant state geologist, New York, "Albany Sand"; William W. Clark, Seymour Manufacturing Co., "Manufacture and Use of Alumino-Vanadium"; C. V. Powell, British Aluminum Co., Toronto, Ont., "Some Developments in Aluminum"; W. M. Corse, The Titanium Alloy Manufacturing Co., "Copper-Aluminum Alloys"; S. L. Hoyt, University of Minnesota, "Amorphous State of Metals"; S. W. Parr, University of Illinois (two papers), "Method of Analysis for Complex Alloys," "Development on Acid Resistance Alloys'"; F. A. J. FitzGerald, FitzGerald Laboratories, "Electric Furnaces for Brass Melting"; H. T. Kalmus, Kalmus, Comstock & Westcott, Inc., "Cobalt in Non-Ferrous Metals"; Thomas F. Wettstein, United Lead Co., "The Effect of the Present European War on the Metal Industries"; Elwood Haynes, Haynes Stellite Works, "Stellite"; Prof. D. J. Demarest, Ohio State University, "Analysis of Babbitt Metals."

INDUSTRIAL NEWS

The Garfield Smelting Co., Garfield, Utah, is installing a 48-in. Symons disk crusher.

The Hardinge Conical Mill Co., announces that the Anaconda Copper Mining Co. is preparing to install 24 more of the 10-ft. diameter Hardinge mills. This makes a total of 44 out of a contract which they made early this year for 60 of these machines.

Morse Bros. Machinery & Supply Co., of Denver, Colo., has purchased the entire power plant recently erected near Wickenburg, Ariz. This plant was built to furnish power for the Octave Mining Co., 14 miles distant, the power being generated at the railroad and transmitted to the mine. The plant consisted of 200- and 550-kw. Westinghouse alternators driven by Corliss engines. The steam plant consists of B. & W. boilers, fired with oil. The transmission line was operated at 22,000 volts and is 14 miles long. All of this material will be dismantled and sold, or removed to Denver. The smaller unit was in use three weeks and the larger one was nexer used.

The present high price of zinc ore is having a stimulating effect in the Wisconsin zinc district. The Dings Electro-Magnetic Separator Co. of Milwaukee, Wis., has recently closed three contracts for magnetic separator equipment to be installed in that district. The Vinegar Hill Zinc Co., Platteville, Wis., continues to enlarge the National roaster at Cuba City, and has just ordered another large battery of Dings magnetic separators. The Utt-Thorne Co., of Platteville, Wis., is now overhauling the custom roaster at Benton, Wis., and has purchased considerable new machinery, including a battery of Dings magnetic separators. Kistler & Stevens, Platteville, Wis., is equipping a roaster plant and has ordered a Galena Iron Works roaster and Dings magnetic separators.

Editorial Correspondence

SAN FRANCISCO—July 21

The Bunker Hill Consolidated Mining Co. in the first half of 1915 mined and milled 42,087 tons of ore, producing a total value of $151,591, or approximate average of $3.60 per ton. The total value is divided as follows: bullion, $48,415; sulphurets, $100,608; rent of tailings, etc., $2568. Mill operated 175 days, 10 hours. The mining expense including payroll, supplies, power and water amounted to $85,113; milling expense including the same items, $8881; sulphurets expense, including assaying, freight and road repair, $5110; a total of $99,104. The general expense amounted to $9338, and a new drill sharpener, hoist control and office equipment added $1350 to the expenses. This makes an aggregate total expense of operation $109,792. In the period from January to June inclusive six monthly dividends were paid amounting to a total of $30,000. A significant fact is disclosed in the item of the net value of the bullion produced. The return of $48,415 from the crushing of 42,087 tons of ore shows a recovery value of $1.15 per ton. The return of $100,608 recovered from sulphurets shows the average value of the sulphurets to be $2.36 per ton. The tailing from the Bunker Hill mill is treated in a merry-go-round and cyanide tanks under a rental or leasing system. The exact value of the tailings is not stated in company reports but the value received from the rental, $2568, probably represents about one-half the total value. The Bunker Hill has paid dividends for several years under the mine superintendency of E. Hampton. Since the necessity arose for installation of a new steel hoist and development of new orebodies, the per share rate of the dividends has been reduced from 5c. to 2½c. The recent installation of Hardinge mills at the Original Amador mine, a neighbor of the Bunker Hill, is expected to prove decisively that regrinding and cyanidation may be as successfully applied to the characteristic Mother Lode ores in the Amador City district as in the Plymouth district, where the first Hardinge mills were installed.

Mine Rescue and First-Aid Training is being given mining men upon application to the United States Bureau of Mines at the Panama-Pacific International Exposition. The station is at the mine exhibit in the Mines and Metallurgy building, and is in charge of several competent men of the rescue force of the Bureau. The first-aid class has been in session from 9 to 11 a.m. daily excepting Sundays, each morning taking up a certain phase of the work so that an applicant would have to attend six classes to cover the entire course. Mine-rescue training is also given on request. This work is of such character that it cannot be done properly by special arrangement of courses, but every effort is made to suit the applicant. The demonstrator of rescue work will spend a good deal of his time in the field in August and part of September, so that the regular classes cannot be continued at all times during these months. Men desiring to take this course of training should make application about two weeks in advance so that they may be provided with competent instruction. A number of miners and mining engineers have taken these instructions and have greatly profited by them. The instruction has been extended to certain branches of the fire department in San Francisco. As a part of the exhibit of the Bureau of Mines, the various paraphernalia employed in rescue and first-aid work are on exhibition, competent men being engaged in giving information to all who ask it. The exhibitions including the mining and metallurgical divisions and the Mine, were awarded one grand prize, six gold medals of honor and two gold medals by the Superior Jury of the Exposition, and all the collaborators in these exhibits received silver medals.

Two Deputy Mine Inspectors, G. Chester Brown and J. W. Gebb have been appointed in the mine-safety department of the California Industrial Accident Commission. Mr. Brown is the senior member in point of time. Other deputies will be appointed from the available list of men who passed the civil-service examination, at such time as their services will be required. The organization of the mine-inspection department is not yet completed and will not be until the tentative mine-safety rules have been finally revised and put into operation. The progress of the inspection of mines under state and United States control has been as rapid as is consistent with the demand for thoroughness. The chief inspector, H. M. Wolfiin, continues to make visits into the mining districts pending the completion of the rules and this work will be augmented by the services of the two deputies. It is not unexpected that the rules may be in some respects materially revised, but as a basis for thorough organization and practical operation the tentative rules have served the purpose and with such revision as is deemed necessary will be put into operation under the provisions of the workmen's-compensation law.

BUTTE—July 22

The Passing of Amalgamated—The dissolution of the Amalgamated Copper Company, the last of this month, will mark the completion of an important and interesting chapter in the history of the copper and other industries. Under the fostering wings of this mighty corporation the Anaconda Copper Mining Co. grew to manhood, as it were, and to be old enough and big enough to take care of itself. The protector has outlived its usefulness and its protegee has grown so great that it is now about to absorb the holding company, awaiting merely the formal action of a board of directors to complete the consolidation. Although the early development of the Anaconda mines under the late Marcus Daly demonstrated the vast possibilities of this property, the launching of the Anaconda Copper Mining Co. in 1895 with a capitalization of $30,000,000 was received with amazement in Butte and Montana. Nothing like it had been experienced in the mining history of the state. Big as the Anaconda stock appeared to the people of Butte, it paled into insignificance four years later when the Amalgamated company was organized with a capital stock of $155,000,000 and with Mr. Daly as its first president. He was succeeded by H. H. Rogers who held the position until 1909 when John D. Ryan became the president. In 1910 Anaconda increased its stock to $150,000,000 and absorbed the properties of the Boston & Montana, the Butte & Boston, the Washoe, the Trenton and the Parrot and finally the Butte Coalition companies, the latter having acquired in 1906 the Butte properties of the late Augustus Heinze. This was followed by the purchase of the W. A. Clark properties, including the Original and West Stewart mines. Thus the Anaconda company grew by leaps and bounds into a concern as big and as influential as Amalgamated itself and in the 21st year of its existence it becomes its own guardian, a free agent, responsible to no other corporation. What this phenomenal growth of the Anaconda company means to Montana and to Butte in particular, is hardly appreciated to its full extent by those who live within its influence. At the present rate of production, Anaconda supplies the markets of the world with more than 300,000,000 lb. of copper per year. The company shares its prosperity with its employees, who receive the highest rate of wages paid to this class of labor anywhere in the world. The daily expenditures of the company for labor alone amount to $50,000. Its taxes reach the sum of $2000 a day. Thus the growing activity of the Anaconda Copper Mining company is a vital factor in the development and prosperity of Butte and the state as a whole, a prosperity that attracts attention throughout the country.

SEATTLE—July 11

A $100,000 Winter Dump was the result of the working last year on Ruby Creek, the largest cleanup ever made in the district. The cleanup, which was finished in June, more than filled a washtub with gold.

GALENA, KAN.—July 17

Promoter Mining Co. Under New Management—M. E. Kirsh has succeeded J. C. Welch as superintendent. The company is operating on a 40-acre lease which it has from the New Century, southwest of Galena. There are 10 shafts producing paying ore. This tract of land has only been opened up for about six months and is fast becoming a great producer. The company is preparing to build a new mill on the ground to enable it to handle the dirt that comes from the mines. Mr. Kirsh was formerly with the Cherokee County Supply Co., but resigned to take charge of the Promoter property. It is the intention of the company to push the development work as fast as possible in order to open up the land while ore prices are good.

Bailey Bros. & Co. on the Southside land is making about $10,000 a week from its mine. It has been in operation for about a year, but recently went to the 150-ft. level and encountered a rich run of ore. A year's cutting is already blocked out and the company is preparing to build a mill to handle the dirt, as the mine has become too large a producer to send the dirt to custom mills.

HOUGHTON—July 18

The Story that Henry Ford is putting considerable cash into several development properties in the vicinity of the White Pine, a subsidiary of the Calumet & Hecla, is vigorously denied by the officials of the companies so connected. There was one story to the effect that Ford had purchased heavily of Onondaga and another to the effect that he was interested in White Pine Extension. While it may be possible that Mr. Ford has bought stock in these companies the officers have no knowledge thereof.

SALT LAKE CITY—July 16

Mining Activity Is General throughout the state, and everybody is working. Attention is called by the National Copper Bank of Salt Lake City to the fact that it is more than five years since there has been anything like the lively interest in mining that prevails today. Many new prospects are being developed; new camps are being found; and old camps and mines are renewing their former activity. The change is not wholly due to the higher prices received for some of the metals, but in part to the restoration of confidence, which has been going on during the last year, and which would doubtless have caused money to be spent in mining development even without the stimulus of higher metal prices. Many lessees are working in Tintic, and Bingham and other camps and there is more activity in Big Cottonwood than ever before. In the south fork of the latter district 14 mines and prospects are working, and employing 130 to 140 men. These properties include the Cardiff, Maxfield, Kennebec, Day's Fork, Big Cottonwood Consolidated, Tar Baby, American Consolidated, Price, Carbonate, East Carbonate, Reed's Peak, Alta-Cottonwood, Baker Group, and Cardiff Extension.

Bingham & Garfield Railway has been assessed $24,000 per mile by the county assessor for Salt Lake County as compared to $13,000 last year. Efforts were made by the company to obtain a reduction before the county commissioners on July 9, when it was pointed out that the rate of assessment is much higher than that fixed by the state board of equalization on any other railroad in the county. At the hearing the commissioners declined to grant any abatement. The question of the rate of taxation of the railroad was made a political issue a year ago, and was one of the points raised at the fall elections.

DENVER—July 16

At Leadville, Pumping at the Penrose continues under the most favorable conditions. The cutting of the station has now been under way about a week, and it is thought that another equal period of time will see this part of the work completed. After that the station pumps will have to be installed, and it will probably be a couple of weeks before any effort will be made to lower the water past its present level. Some idea of the immense body of water that has to be drained may be derived from the task which the sinking pumps now have in keeping the water down below the station level. During part of one night last week one of the machines was shut down, and with the other working at full capacity it took the water only five hours to rise within a few feet of the station. With the two pumps running, however, it would be possible to drain the shaft still deeper with a lift of 470 ft. or more to throw the water. No trouble has been encountered in cutting the station. One side near the shaft was rather inclined to cave, but it proved more of a help than a hindrance to the work.

KNOXVILLE—July 12

The American Zinc Co. of Tennessee has begun work in the addition to its plant at Mascot. The company has within the last few months spent $75,000 to increase its concentrating mill so that increased output might be secured. The company recently purchased the Roseberry mill, and with a large force of hands is placing the old plant in condition to give an additional output of 400 tons daily. H. S. Kimball, president of the American Zinc Co.

FAIRBANKS—June 21

Tolvana Has 300 Prospectors Now. Owing to the lack of machinery and water the output for this season will probably not exceed $10,000. About $1000 has already reached Fairbanks. The gold from Livengood Creek assays from 905 to 920 fine and nets from $18 to $19 per oz. Olive Creek gold assays 903 and nets about $18 per oz. August Peterson has abandoned his lease on Olive Creek and will move his plant to McCord and McCarthy's ground on Livengood.

Tolovana Still Looks Good to the placer miners, although not enough has yet been found to prove that the camp will be more than a small one. Pay has been found at several points for more than a mile along Livengood Creek and on several adjacent creeks, of which the most important seems to be Olive. Among the more recent discoveries may be mentioned that of Sullivan & Johnson, who have found pay at a depth of 118 ft. on the fourth-tier bench claim, right limit of Livengood. This pay is 500 ft. toward the hill from that lined up by Cascaden, Wagner and others, and is held to indicate a very wide paystreak. Dollar ground has been found on Gertrude Creek, a small "pup" entering Livengood at 5 Above Discovery. This paystreak is said to be about 12 ft. wide. Teddy Hudson has bonded No. 5 Above to Tom Knowles for $12,000.

TORONTO—July 24

The Government of Ontario on July 20 announced the appointment of a commission to enquire into the feasibility of refining nickel ore entirely within the province. The committee consists of George J. Holloway, London, England, chairman; Dr. Willet G. Miller, provincial geologist, Toronto; James McGregor Young, K. C., Toronto; and Thomas W. Gibson, Deputy Minister of Mines, Toronto, Secretary. The appointment of Mr. Holloway, as chairman, was made as the result of a consultation with the British Government, which desired that a competent metallurgist should occupy the position. In taking steps to secure an entirely suitable man, the British Institute of Metals was approached and Mr. Holloway was recommended as in every respect qualified for the post. He is an associate of the Royal College of Science, London, examiner in metallurgy in the Institute of Chemistry and University of Birmingham, and vice-president of the Institute of Mining & Metallurgy, London, in addition to holding other responsible positions. James McGregor Young is professor of constitutional and international law at Toronto University. No time will be lost in beginning the investigation. The Commission or some of its members will probably go to Norway to investigate the refining process employed in that country, and it is expected that at least one of the commissioners will visit New Caledonia to examine the methods in use there.

GUANAJUATO—July 15

Difficulty of Getting Supplies of any kind into the mines, or of shipping bullion from them, has necessitated a considerable curtailment of operations. It was intended to discontinue operations entirely on July 1, but it is not certain whether or not this has been done. Supplies of cyanide and other essentials to operation have been divided among the mills in order to postpone cessation as long as possible. If operations could be continued, that is, if supplies could be obtained, the operating companies would earn more money than in normal times, since they are purchasing ore on extremely favorably terms, and holding bullion until the proper opportunity appears to ship it out of the country and obtain payment in gold, or credit on that basis. About 100 Americans are still in the camp, but most of those having families have left or sent their families away. One recent arrival reports that it took him about 12 days to make the trip from Guanajuato to Vera Cruz, a journey which ordinarily can be made in 24 hours.

Pinguico Mine and Mill of the Guanajuato Development Co. has been abandoned some time ago due to the working out of the orebody. This property had a meteoric existence, having been discovered only since the operation of foreign companies on a large scale in Guanajuato. The Development company took over the mine, opened it up and milled ore averaging more than one kilo in silver for some years. The mill was a modern sand and slime installation of 200 tons daily capacity, but since the exhaustion of the mine, has been dismantled and used in other places. The San Matias mill and the Peregrima mill of the Development company have been worked as long as supplies could be obtained.

Guanajuato Reduction & Mines Co. has been operating the mill as long as supplies lasted, extracting some ore from the mines and filling up the remainder with purchased ore. Guanajuato has been annoyed by descent of large bands of the armed followers of one or another of the forces now combatting for power but has not been subjected to systematic looting as has been the case at Leon, the largest city in the state of Guanajuato. General Obregon, upon his entry into Leon, granted his soldiers a 3-hr. privilege of looting indiscriminately. At the end of that time little of value remained in Leon.

The Mining News

ALASKA

BONANZA COPPER MINING CO. (Valdez)—Ore on this property is now running about 70% copper and shipments so far average about $1,500,000 per month.

AMERICAN SMELTING & REFINING CO. (Tacoma, Wash.)—Copper refinery here, following a conference of this company and the Tacoma Smelting & Refining Co., will be doubled in capacity this summer.

NEW PLACER STRIKE has been made on Hadxana River opposite mouth of Birch. Find made on Trout Creek, but ground has not been sufficiently prospected to demonstrate extent of pay. Discoverers found 3 oz. of gold in the bottom of their first hole.

McWHORTER and ARTHUR (Stewart River)—New and permanent quartz camp has been established on Stewart River by development of this mine on Galena Creek in Mayo district. Shipment of 1500 tons silver ore recently made from mine to Tacoma smeltery and is expected to return $300 per ton.

THREE-MAN MINING CO. (Valdez)—Shipments of 800 tons made from this property on Landlock bay so far this year, and from 200 to 400 tons of picked ore will be shipped to smelter each month during balance of year, with larger shipments as facilities for handling are bettered. The present high price of copper is making the ore particularly valuable.

GRAFTER MINE (Whitehorse)—Closed down several years ago, is to be reopened and shaft, partly filled with water, now being pumped dry. Approximately 200 tons high-grade copper ore on dump now from old workings. With high price of copper many of the other copper properties of this district will start operations. J. P. Whitney, E. A. Dixon and George Armstrong are the owners of the Grafter.

THE MOST VALUABLE CARGO LEAVING ALASKA in the history of territory has recently cleared from Cordova on Steamer Mariposa of Alaska Steamship Co. carrying a cargo valued at $1,600,000, which consisted of 1200 tons of copper ore, $840,000; gold dust and bullion, $700,000; and raw furs from interior, $60,000.

ALASKA TREADWELL MINING CO. (Juneau) — Power plant for the Alaska Mexican claim of this company has been completed and is now in operation. Consists of one 750-kw. turbine and one 2000-kw. turbine, which are in addition to the former two units of 1000 each. A small log-crib dam was constructed during the winter at one of the power plants in order to increase the head with a corresponding increase in power. Lower part of mine is now being opened up by levels driven into it from 700-ft. level of Alaska United Co.

READY BULLION (Juneau)—Work started on a new incline shaft equipped with electric man- and ore-hoists, with steel headframe which will open up mine at a depth of 200 ft. below present level (2200 ft.). Old incline shaft started in footwall, but owing to unexpected straightening up of vein, is now well in the hard, greenstone hanging wall. The new shaft will keep entirely in the footwall slate, and will release large bodies of ore now remaining in the mine to support the old incline shaft where it crosses from the foot to the hanging wall.

NO. 13 ABOVE, FAIRBANKS CREEK (Fairbanks)—Allis-Chalmers 5-stamp mill shipped into Fairbanks district by Edward McConnell several years ago has been bought by Thomas Gilmore, who plans to erect it on No. 13 Above Discovery, Fairbanks Creek, adjoining Heilig custom mill.

RHOADS-HALL (Fairbanks)—J. H. Patterson plans to recrush accumulated tailing from Rhoads-Hall mine in tube mill that he is building in Fairbanks at shops of Samson Hardware Co. Mill is an experiment but Patterson hopes to recover several dollars a ton from tailings, and prove feasibility of undertaking.

GREAT INTEREST IN STIBNITE is being shown by Fairbanks quartz miners since Silas Scrafford shipped 120 tons of hand-picked antimony ore from the property of the Chatham Mining Co. Many gold-quartz veins carry stibnite, chiefly as isolated bunches comparatively free of quartz and barren of gold. Smith & McGlone plan to make test shipments from head of St. Patrick's Creek and Thomas Lloyd plans to send a small lot from Kantishna. Transportation companies have reduced rates to encourage industry.

ARIZONA

Maricopa County

BUFFALO-ARIZONA (Hot Springs)—Harry J. Bennett, of Phœnix, and associates have begun shipping copper ore to smelter at Humboldt. Considerable 15% ore on the dump.

Mohave County

CHARCOAL CAÑON (Kingman)—A. W. Clapp carrying on development work. Good orebody uncovered. Ore is lead carbonate mostly, but in shallow shaft a fine body of galena has been struck.

Cochise County

NEW CORNELIA (Ajo)—It is estimated by President Charles Briggs of the New Cornelia Copper Co., which is a subsidiary of the Calumet & Arizona company, that the pit equipment, power houses and other necessary works for the proposed 4000-ton leaching plant will cost over $3,000,000.

Yavapai County

ANTELOPE PARK (Rich Hill) — Dan B. Genung purchased mineral holdings of Harrison Yarnell. Preparing to develop the property on a large scale.

CALIFORNIA

Sierra County

MONARCH and CLEVELAND (Sierra County) — Quartz mines, being developed by R. G. Gillespie, of Pittsburgh, Penn. Mill running steadily on good ore.

PLUMBAGO (Alleghany)—Fifteen-stamp mill to replace plant destroyed by fire was built in less than one month and is running on rich ore, many hundred tons of which are blocked out and in sight. Owned and operated by Croesus Mining Co., of New York. W. B. Pearson in charge.

SACRED MOUNT (Sierra City)—Cyanide plant completed and in operation on tailings which assay over $9 per ton. Jay C. Folsom in charge.

SOUTH FORK (Forest)—Gravel and quartz. Vein has been encountered which is believed to be same as that in famous Tightner mine at Alleghany. Splendid returns being received. C. Weeks, of Los Angeles in charge.

SIERRA BUTTES (Sierra City)—Oldest quartz mine in Sierra County, and second oldest in California, operated continuously since 1851, has developed a new ledge 6 ft. wide, with 1100 ft. of backs, containing a payshoot that will practically make a new mine of the property. Hayes Brothers, of San Jose, owners. J. E. Westall in charge.

Shasta County

SALE OF ASBESTOS CLAIMS, 44 in number, and located on Mears Creek west of Sims, made recently to San Francisco men.

DREDGE INSTALLATION ON COTTONWOOD CREEK, near Gas Point, being made. Dredge of large capacity. Quarters for employees also being built.

NOBLE ELECTRIC STEEL CO. (Heroult)—Daily production 10 tons ferromanganese being made with one furnace. Second furnace to be started within few days. Ore is supplied by mines in Modoc county. Force of 80 men employed at plant.

MAMMOTH COPPER MINING CO. (Kennett)—Mine and smelting plant operating steadily. In addition to copper ore smelted, large tonnage 40% zinc ore being shipped to Oklahoma smelting plants.

MOUNTAIN COPPER CO. (Keswick)—New 250-ton concentrating plant put into operation recently. Only low-grade ore of mine concentrated; this is pyrite and chalcopyrite in silicified ground mass. Jig concentration used. On July 10, Shay locomotive of down-coming company ore train jumped track at trestle. Engineer and fireman killed.

BALAKLALA (Coram) — Prominent metallurgical men visited smelting plant recently. Statement given out by Mr. Newhouse indicates plans being made for resumption of operations at Balaklala smelting plant, Coram, after installation of some fume-precipitation process, probably latest Cottrell improvements. Smelting plant was closed July 1911 by "smoke suit" brought by farmers of valley.

Amador County

SOUTH EUREKA (Sutter Creek)—June dividend was paid July 15. Eighty-stamp mill in regular operation and 250 men employed. William H. Schmal is superintendent.

Butte County

EUREKA (Magalia)—This mine, on Little Butte Creek, has been purchased by Frank E. Whitlock and associates. Property was a good producer in early days.

SUCCESS & RUSSELL (Oroville)—G. W. Rumble, of Berkeley, made defendant in damage suit for $25,000, brought in Superior Court in Oakland by Barton Pitts, of Oroville. Pitts charges he was falsely accused by Rumble and arrested on a charge of stealing ore. Rumble was later arrested on a charge of perjury in connection with suit brought by E. J. Coglan to collect $5000 commission. Rumble has been in similar troubles connected with mining operations.

STEIFER MINING CO. (Chico)—Stockholders filed amended complaint in Superior Court asking that $51,000 assessment, recently levied by the directors, be declared invalid and directors restrained from selling stock for nonpayment of assessment. There are 530,000 shares, of which Steifers owns 309,064. Amended complaint alleges these shares were given Steifers by directors and that P. B., H. M., M. V., and Mary Steifer form majority of the directorate. The other members are J. M. Cline and Erasmus Wilson. It is also recited that two mortgages totaling $89,000, held by Mary Steifer against company are fictitious and that thousands of dollars expended in construction was done merely to make a showing and not for benefit of mine.

Eldorado County

RYAN (Shingle Springs)—Machinery being assembled for installation at this mine at Frenchtown, recently purchased by N. B. Ryan, of Manhattan, Nev. A 100-ton crusher will be installed.

COFFIN & REED (Placerville)—San Francisco men are negotiating for purchase of property and also Linden mine, owned by Stricker Co. Linden has been a producer. A 1400-ft. tunnel has been driven to work both mines, from which upraises will be run.

Kern County

WERINGER (Woody)—High-grade copper ore reported in addition to large body of medium-grade ore. This encourages contemplated installation of a 200-ton John D. Fields leaching plant. Plant will be electrically operated and will cost $35,000.

COLORADO

Boulder County

HERALD (Boulder)—R. M. Davis received settlement for lot weighing 8 tons. Net returns, $1287.50 assay showing 9.73 oz. gold and 5.50 oz. silver. Has wide vein from which he will be able to make similar shipments while reserving ore suitable for milling later.

FOREST HOME (Nederland)—While sinking shaft in this property of Boulder Tungsten Production Co., miners broke into flooded workings of Cold Springs No. 2 mine of Wolf Tongue Co. Nobody injured, but incident has aroused a question as to apex rights that may result in litigation, Cold Spring vein being one of best producers of Wolf Tongue Co. During past two years, leasers Munson and McKensie have shipped good tungsten ore from this vein. William Barnett, 82, while trench-mining, was killed by cave-in, on July 12.

San Miguel County

TOMBOY (Telluride)—New electric hoist installed at the Cincinnati shaft, to raise ore from Montana property to mill level. During June 100 cars of ore and concentrates were shipped from Telluride to the smelters. Shipments include 24 cars from Smuggler-Union, 12 cars from Liberty Bell, and 55 cars from Tomboy to the Durango smelter; and 8 cars of zinc concentrates from Colorado-Superior Mining Co. to Blende.

Teller County

LAST DOLLAR (Altman)—Contract has been awarded to sink the shaft 100 ft. to total of 1480 ft. Probable that sinking will be continued after completion of contract. Development operations in progress on 900-ft. level on company account, and four sets of lessees carrying on exploratory work in other parts of property. Much payable ore opened. M. B. Rapp, manager.

JERRY JOHNSON (Cripple Creek)—Cripple Creek Deep Leasing Co. has outlined plans for extensive campaign of development in this Ironclad Hill property. Lease has been secured on all ground below 650-ft. level and sinking will begin within a few weeks. The company proposes to sink shaft another 500 ft. Working fund of $25,000 has been provided to carry on work. New 100-ton cyanide mill nearing completion and will probably be ready for operation within next 30 days.

San Juan County

EMMA (Silverton)—J. A. McCrimmon is having a carload of heavy lead ore packed on burros from this mine in Ice Lake basin.

BIG GIANT (Silverton)—Peter Orella has developed a large shoot of milling ore and is shipping stuff from the high-grade streaks.

SILVER LEDGE (Silverton)—Louis Bonavidi, operating the mill under lease, is running steadily and making lead concentrate and zinc concentrate.

PRIDE OF THE WEST (Silverton)—John B. Giono is shipping small tonnage of high-grade while developing large body of low-grade milling ore.

MICHIGAN

Iron

WHITE PINE (White Pine)—Question of railway connections seems unsettled at present time.

PEWABIC (Iron Mountain)—Management has given orders to work on full time. Men have been working four days per week for a number of months. The mine will soon be exhausted of merchantable ore. Fifty miners have been added.

NORTH LAKE (Houghton)—Is sinking at the rate of 50 ft. a month on the way from the 340-ft. level to 800-ft. depth. Osceola lode at any time now.

NEWPORT (Ironwood)—New record for loading iron ore on Gogebic range made few days ago at Newport. In 10 hr. one shovel loaded 162 cars from stockpile. Nearly 8000 tons handled by one shovel. The best previous record held by Colby at Bessemer. That mine loaded 150 cars in same time.

SOUTH LAKE (Houghton)—New compressor is in operation and four more drills will start at work Tuesday, making 12 machines in all at work in this mine. They are increasing the stock pile to good size and shipments of rock will start very soon.

NEW ARCADIAN (Houghton)—Will probably make another shipment of rock before the end of this month. This rock will come from the south drifts and will be sent to the mill and smelter for the purpose of getting a good line on results that can be expected from southern openings. At the present all energies underground are directed to the development of the amygdaloids. No drilling is being done at present on the conglomerate recently opened.

FRANKLIN (Houghton)—Crosscut expects to hit the orebody and plans for further development depend on its character where cut. In the meantime the showing in the Allouez conglomerate continues rich. Eighteen machines are in operation and most openings are in better character rock than expected. Electric haulage will be installed immediately, meaning a saving in rock handling underground and an increase in rock shipments to 1200 tons per day.

HANCOCK (Hancock)—Is shipping 400 tons per day, average, but working 30 machines. Four of the Pewabic series are being opened, Nos. 3, 4, 8 and 9. This latter is the richest of the series and No. 4 is next in copper content. Good-grade rock is coming out and increase in shipments can be figured shortly. To date there are no smelter returns on the limited shipments already made. Work through the Quincy shaft likely to commence soon.

COPPER RANGE CONS. (Painsdale)—In addition to fact that both Baltic and Champion mines today are turning out richest continuous production of high-grade copper in their history fact also is generally known that all of development work underground is showing better-grade of rock than average in lives of these two mines. Trimountain continues to improve materially. From 20 to 27 levels of No. 2 good ground is developing. In Baltic, shoot from 28 to 29 levels in No. 3 is showing good ground.

MONTANA

Granite County

BOULDER MINING DISTRICT—Bond and lease has been taken by Butte parties on Bluebird group of mines, six miles above Princeton. Group consists of eight claims on which about 2200 ft. of tunneling has been done. Ore on different claims runs on an average of $67 a ton in gold and silver, copper and lead. The Butte men will start development work within a few days.

Mineral County

IRON MOUNTAIN MINE (Missoula)—Federal Mining & Smelting Co. bought this mine at a sheriff's sale, with mill and equipment for $111,000; 10% down, balance on delivery of deeds and possession. Company also owns power line, 11 miles long to Paradise, fully equipped power plant and substantial buildings. Mine located about three miles from Superior, the county seat. It is a silver-lead producer and hundreds of thousands of dollars were taken from it in the early days. Production began 14 years ago and lasted for 8 years, during which company paid more than $500,000 in dividends besides building a 250-ton mill and 15 miles of mountain road.

BUTTE & SUPERIOR MINING CO. (Butte)—Concentrates valued at $118.797 per ton recovered by oil-flotation process in company's mill during June, according to monthly statement filed in Federal court in compliance with order of court made in suit brought by Minerals Separation Co. Assays are highest recorded in mill in months, 36,206 tons of ore were treated in June and 8397 tons of concentrates were recovered at a cost of $4.08 per ton.

BULLWHACKER COPPER CO. (Butte)—Company is taking out ore at present from its property at rate that warrants fair profits from now on. During June, 37 cars of ore were shipped, for which a total of $3651 was received. June pay roll was $2748; net profits after paying all expenses were over $500. During July tonnage is being increased gradually and it is probable that there will be a profit of from $2500 to $3000 or close to $100 per day.

RAVEN COPPER CO. (Butte)—Notices have appeared in the daily papers that on Aug. 4, 1915, this company will sell at public auction to highest bidder, at Centerville, near Butte, all of its property in Silver Bow County, consisting of Raven lode-mining claim and interests in other smaller ones. Also town lots, mining and surface rights together with all buildings and improvements, all machinery and equipment. Sale to be held at shafthouse on Raven claim. Deposit of cash to the amount of $25,000 or a certified check for that amount, will be required before a bid will be accepted. J. A. Poore, Butte, is authorized to give further particulars. Raven is one of the older properties on the Anaconda hill and has been a large producer in days gone by. It has been idle for several years.

Beaverhead County

BOSTON & MONTANA DEVELOPMENT (Elkhorn)—Crosscutting to central veins has been started from 2000-ft. point of the big main tunnel, and it is expected that one of them will be reached within a distance of 300 ft. depending on dip of veins. Good reports of developments and mineralization are being made to Butte office by Superintendent Hopkins.

ARGENTA MINING DISTRICT—A deal has been closed involving Lewis Phillips and Rittenhouse claims, and Rittenhouse millsite in this district. Property turned over to Alexander Walker of the National Oil Co., who represents outside interests who contemplate the development of large orebodies exposed in present workings and on surface. Ore exposed in shafts runs as high as 60% lead, 50 oz. silver and $7 in gold. On south end of property opencut work has shown good values in copper, gold and silver.

Silver Bow County

BUTTE DULUTH (Butte)—Captain Wolvin has been in New York for several months trying to raise funds to relieve financial situation. Now stated that he has been partially successful and will soon be back in Butte.

DAVIS-DALY (Butte)—Stoping begun on new orebody on the 2500-ft. level of Colorado mine. Orebody opened for 150 ft. and is reported to have average width of about 5 ft. and carry 7% copper.

ALICE MINE ORDERED SOLD BY COURT—Judge Bourquin in United States Court at Helena signed interlocutory decree July 3, under which property of Alice Gold & Silver Mining Co. will be offered for sale. Order made in action brought by Peter Geddes and other minority stockholders in Alice, who wanted sale to Anaconda company set aside. John Lindsay of Butte named as special master for purpose of carrying out decree. No bid for property below valuation at which property was taken over by Anaconda company will be considered. If no sale is made, then previous sale to Anaconda company will stand. Fifteen hundred dollars for 45 tons of ore taken from lease in Alice mine is the amount paid recently to mining man of Walkerville. Price averages $33.33 a ton and is for silver ore. There are number of leasers on Alice, as well as in other properties in Walkerville district. Unpatented claims to north of Walkerville for distance of two miles present busy outlook. More assessment work being done this month on over hundred claims. Tom Weber, one of leasers on West Salvador, has struck 6-in. silver vein at depth of 75 ft. Dave Davis has lease on same claim; is sinking 90-ft. shaft.

BUTTE-BALLAKLAVA (Butte)—Anton Donati and others have started suit against company to recover profits on lease of portion of company's mine. It is claimed plaintiffs and company entered into an agreement Feb. 1 last, in which former were to mine on 1600 level of property; that work was started on Mar. 17 and continued until Apr. 30 when plaintiffs were ordered to quit and surrender possession of place. It is alleged that company shipped ore from returns of which plaintiffs should have received $575.84. It is also claimed that 50 cars of ore were left in place from which they should receive as their share $5500. They say contract called for 30 days' notice before it could be terminated.

ACTIVITIES IN DISTRICTS TRIBUTARY TO HELENA—About 50 tons of ore are being treated daily and force of 25 men is employed in mine and mill of York Mining Co. whose property is located across Missouri River near Helena. L. D. Armstrong who is working two claims in Minnehaha gulch two miles above Rimini, started tunnel, last 60 ft. of which has been in ore running from $30 to $40 in gold and silver. Frank Jama, who is working prospect at head of Lump Gulch, struck vein of galena and lead-silver ore running $80 per ton. Ed. Horsky and associates of Helena have promising property in Centralia group, two miles south of Blossburg whence they are shipping ore every month that averages from $700 to $800 per car.

BUTTE-ALEX SCOTT (Butte)—Has declared dividend of 15c. per share. Local shareholders had expected 50c. New hoisting engine has been ordered and will be installed by Sept. 1. New headframe will also be built during August. Shaft will soon reach the 2200-ft. point and a new level will be opened. New cages and 3-ton skips also to be installed, all proposed improvements to cost about $25,000. About 200 tons ore per day hoisted. Will be increased to 300 and 350 tons. June production about 500,000 lb. copper.

TUOLUMNE (Butte)—Officers of company are still urging shareholders to "come through" with loans with which to provided a fund for resumption of operations, but responses are not very general. About $20,000 pledged and about $15,000 more is wanted to pay running expenses for a month or two until returns from ore shipments come in. There is a large quantity of ore in the upper levels of the Tuolumne that can now be mined at a profit. Years ago, when present management worked mine to make a showing, when insiders waived dividends and public was paid from the profits of high-grade ore that was mined, this low-grade was left undisturbed. In those days stock, on the company's fine showing and dividends, went to $5 per share, and when some facts became public it dropped to about 25c. per share. Now around 45 cents.

NEVADA

Esmeralda County

TONOPAH BELMONT (Tonopah) has cut 6 ft. of rich ore in raise above 1100-ft. level.

RESCUE-EULA (Tonopah) has broken through wall of main ledge on 900-ft. level.

MONARCH-PITTSBURG (Tonopah)—Northeast crosscut on eighth level has broken into commercial ore. Ledge cut is farthest west in district.

WEST END (Tonopah)—Is installing electric hoist below 600-ft. level in Butler ground, and will immediately begin extraction of ore under stipulations entered into recently.

Storey County

UNION CONSOLIDATED (Virginia City)—West crosscut on 2650 level extended to 710-ft. point, the face being porphyry and quartz.

OPHIR (Virginia City)—Saved 280 cars of mill ore from Central tunnel and milled 270 tons. Favorable indications throughout tunnel level in development work.

MEXICAN (Virginia City)—From 2300 level delivered to the mill bins 390 tons of ore, average assay value $8 per ton. Reopened main Comstock lateral drift on 2500 level. Crushed 135 tons of ore, averaging $8.36 per ton.

JACKET - CROWN POINT - BELCHER (Gold Hill) — Received at mill 668 tons of dump rock and 199 tons of mine rock; shipped bullion to smeltery. New stope being opened in Belcher 1300 level, and 67 cars of mill ore saved.

UTAH

Summit County

PARK CITY SHIPMENTS for week ended July 9 amounted to 3,276,197 lb., by five shippers, the output being lessened somewhat by Fourth of July holiday.

MINES OPERATING (Park City)—Machinery from company's property being shipped to Tintic to be used at new plant to be constructed by Tintic Milling Co. Contract for excavation and building will be hurried so as to have plant in operation by Jan. 1, if possible. Geo. H. Dern is general manager.

Salt Lake County

SELLS (Alta)—Eight or 10 in. of sulphides carrying lead and silver being followed in south drift. Mineral-bearing ground opened for 130 ft. Two shifts being worked.

BINGHAM-NEW HAVEN (Bingham)—Parr lease at this property reported to be making money.

SOUTH HECLA (Alta)—Wedge orebody being prospected for on the 500 level, and 200 ft. additional work will be necessary to reach it.

CARDIFF (Salt Lake)—New equipment, including electrically-driven compressor, being installed. Surface improvements also are being made. Fifty-five teams hauling ore.

WASATCH MINES (Alta)—Zinc ore being shipped from the deposit on the hill, and lead-silver-copper ore from No. 5 stope of main workings. Indebtedness has been reduced to about $5000.

UTAH COPPER (Bingham)—Now operating at 100% capacity for first time in its history. Stripping is now so far advanced that mine can produce tonnage as rapidly as any increase in milling capacity can be constructed. One day, recently, 28,000 tons of ore were treated in mills whose original capacity was figured at 21,000 tons. It is believed that this can be increased to 30,000 tons per day without further construction cost.

UTAH-APEX (Bingham)—Some changes being made at the mill. Settling cones being taken out, and large shallow tanks installed, possibly also flotation machinery. Electromagnetic process may be employed later to separate lead and zinc. Daily shipments of 125 tons of lead ore and 100 tons of concentrates being made. Two miners caught in between Minnie and Andy tunnel levels were rescued after 20 hr. of imprisonment.

Iron County

SILVER PEAK (Lund)—Articles of incorporation have been filed by this company owning six claims in Blair district, 25 miles south of Lund. Capitalization is $10,000. R. B. Shepherd is president. Development consists of several shafts, and property has been opened to depth of 175 ft. There are about 60 tons of silver-copper-gold ore on dump.

COPPER ZONE (Lund)—This company, recently organized, will work claims in south Bullion Cañon, about four miles from Silver Peak. Capitalization is $10,000. There are two shafts, one 100 ft. deep, and one 200 ft. W. W. Wiscome is president.

Box Elder County

GRAND VIEW MINING (Ogden)—This company has been incorporated to develop zinc ore in neighborhood of the recent strike on Promontory Point. Capitalization $500,000. Incorporators are Chas. H. Smith president; O. H. Mohlman; G. Vaughn; W. P. Watson; G. Manning. Zinc ore of good grade opened recently on Promontory point, and is being shipped at a profit.

Juab County

GODIVA (Eureka)—Lead-silver ore with some gold being mined by lessees, from four blocks of ground.

RIDGE & VALLEY (Eureka)—Lessees mining lead-silver ore from 900 and 1100 levels. Work being done through the Gemini.

TINTIC SHIPMENTS FOR WEEK ended July 9 amounted to 131 cars by 21 shippers, as compared to 169 cars the week preceding. Lessened output being due to closing down of most of the mines over the Fourth.

LOWER MAMMOTH (Mammoth)—Ten blocks of ground are being worked under lease, from one of which—on 1500 level—car of 40% zinc ore was shipped week ended July 2. Company is producing silver-copper ore from 1000 level.

IRON BLOSSOM (Silver City)—Quarterly dividend of 5c. per share, or $50,000, declared, payable July 26. Heretofore regular rate has been 10c. per share, and thus far in 1915 $200,00 has been paid. Total to date amounts to $2,420,000. June shipments were 86 cars.

McINTYRE MILL (Silver City)—Several thousand tons of tailings from one of early mills on McIntyre ranch are to be marketed. These will be loaded on cars of S. P., L. A. & S. L. railroad near ranch, and shipped to Garfield. Value is principally copper, with some silver and gold.

GOLD CHAIN (Mammoth)—Ore carrying lead, silver and gold has been opened from 1500 level of Lower Mammoth, and shipment has already been made from this strike, considered one of most important in over a year. When orebody has been further developed connections will be made with main Gold Chain workings. Ore is being mined on 300-, 400-, 500- and 700-ft. levels. Eight cars were shipped in June.

CHIEF CONSOLIDATED (Eureka)—Dividend of 5c. per share been declared, payable Aug. 2 Rise in the price of lead added materially to earnings. Property is one of heaviest shippers in Tintic. Extensive leasing operations recently been inaugurated. Several additional mining claims in North Tintic lately acquired. Water secured for Scotia mine in West Tintic under lease to Chief, and pipe-line about a mile in length being laid so that this can be pumped over to mine and do away with hauling water from Cherry creek.

CANADA

Ontario

SCHUMACHER (Timmins)—Shaft down 440 ft. and being put down to 600-ft. level. Wide quartz vein has been cut at 300-ft. level.

TRETHEWEY (Cobalt)—Directors have been authorized by shareholders to purchase a controlling interest in the Rochester mine, on which work has been suspended for some years.

DOME LAKE (Porcupine)—Weekly cleanup July 15 realized over $5000. Vein on 400-ft. level 18-in. wide, said to run $20 per ton. Good ore also encountered in winze being put down from 180-ft. level.

VIPOND (Porcupine)—Strike recently made on 400-ft. level shows rich ore. Another find made on 200-ft. level. Management decided to issue a regular monthly statement.

HAYDEN (Timmins)—Camps for accommodation of 80 men have been erected. Plant comprising a compressor and hoisting outfit will be put in. Shaft down 109 ft. and two orebodies have been encountered. Ore growing richer with depth.

McINTYRE (Porcupine)—Has purchased controlling interest in Pearl Lake and new company will be formed to operate it, to be known as McIntyre Extension. Deal gives McIntyre use of the Pearl Lake shaft, 600 ft. deep, close to their boundary, and economies can be effected by joint operation.

PORCUPINE-CROWN—Between 50 and 60 tons of tailings already treated by amalgamation is being put through cyanide plant daily to extract residue of gold. Tailings have average gold value of $3.15 per ton and company has 15,000 tons on hand.

TEMISKAMING (Cobalt)—Statement for June shows bullion in storage and bagged ore amounting to 730,270 oz., valued at $350,000. In new vein system opened up on 400-ft. level there is vein 5 in. wide of 3500-oz. ore, which has been drifted on 135 ft. and is now within 20 ft. of Beaver line. New hoist being installed to reach lower contact between diabase and Kewatin at depth of about 1600 ft.

SOUTH AMERICA

Colombia

NECHI MINES (COLOMBIA), LTD. (Zaragoza)—Oroville Dredging Co., Ltd., parent company, reports that Nechi dredge is expected to be ready by the end of August to start work on San Francisco property, opposite the Pato.

The Market Report

Metal Markets

Again all of the principal metals were weak and reactionary, the declines in copper and spelter being considerable, while those in tin and lead were relatively slight.

Copper, Tin, Lead and Zinc

Copper—The market was dull and quotations throughout the week are essentially nominal, the producers transacting scarcely any business. Many of them were, however, trying to find a level upon which copper would move, and in their efforts they were more active than in the previous week. The transactions reported among dealers were devoid of significance, for the producers would not show their hands on relatively trifling business. All through the week copper was obtainable in round lots at sharp concessions, and during the latter part was to be had at 18@18¼c., regular terms, equivalent to about 17.80@18c., cash, New York. At the close of our week of record there were indications that domestic consumers would become interested at the existing level, or a shade lower.

The British Government decided to release raw copper for export with certain stipulations and guarantees, as we indicated last week. Some of such copper is now on the way to American refiners.

Copper Sheets have brought 25@26c. per lb. The principal manufacturer makes no base quotations. Wire is quoted at 21@21½c. per lb. at mill.

Copper Exports for the week ending July 10 are reported by the Department of Commerce at 5,934,615 lb., the larger items being 2,240,939 lb. to Russia, 1,612,389 lb. to France, 976,576 lb. to Italy and 922,763 lb. to England. Imports for the week were 6,742,089 lb. metal and 3,232,545 lb. in ore and matte; 9,974,634 lb. in all, from Japan, Canada, Chile and Cuba.

For the week ended July 17 the total exports were 6,361,262 lb. Imports were 6,021,033 lb. metal and 2,065,286 lb. in ore and matte; 8,086,319 lb. in all.

Tin—The price for this metal declined owing to continued lack of demand. Deliveries for July will be large, explaining to some extent the recent absence of buying.

Exports of tin from the Federated Malay States in June were 4048 long tons. For the half-year ended June 30 the totals were 24,902 tons in 1914, and 23,318 in 1915; a decrease of 584 tons this year.

Lead—The same conditions continued to exist as we reported last week. Producers firmly maintained their price of 5.75c., New York, and did some business thereat, while second-hands sold lead as low as 5.50c., New York. If a manufacturer desires to buy he is apt to find that he must go to the producers and pay their price, while if a trader has to sell, he is obliged to take what he can get. In other words, the lead market has been extremely narrow. There appear to be some signs of revival of buying for ammunition, and there are no discoverable signs of weakening on the part of the producers. On the contrary, the opinion is expressed that the maintenance of a price of 5.75c. is necessary in order to keep production up to the required level, which is considered to be necessary in view of the continued idleness of one of the large Coeur d'Alene producers. There is no reason to believe that the stocks of lead in the hands of smelters and refiners are increasing.

Spelter—The price declined from day to day upon offerings by smelters who were anxious to sell and consumers who had overbought their requirements and were desirous of disposing of their surplus. There seems to be considerable tonnage of spelter available for prompt delivery, and the difference in the prices for such and for fourth-quarter contracts is narrowing. The reported transactions for the week amounted to several thousands of tons, the aggregate being larger than in the previous week. Galvanizers were buyers to a small extent. A small tonnage was reported sold for export at the beginning of the week, but later there were no buyers either in England or France. Brass special spelter was sold at a relatively small premium over prime Western, transactions being reported at 19@19½c., including prompt delivery.

Zinc Sheets are strong, base price $27 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras charged. The demand is steady and business is good.

Exports from Baltimore for the week included 254,580 lb. zinc dross to Liverpool.

Other Metals

NEW YORK—July 28

Aluminum is rather quiet though there is a fair amount of business forward. Prices are just a shade easier at 31@33c. per lb. for No. 1 ingots, New York.

DAILY PRICES OF METALS IN NEW YORK

July	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
22	4.7650	47½	*18.55 @18.80	36¾	5.55 @5.75	5.50 @5.55	17.00 @18.50
23	4.7638	47⅛	*18.30 @18.55	36½	5.55 @5.75	5.50 @5.55	16.50 @18.00
24	4.7650	47½	*18.00 @18.25	36⅛	5.55 @5.75	5.50 @5.55	16.50 @18.00
26	4.7638	47⅛	*17.80 @18.00	36½	5.50 @5.75	5.40 @5.50	16.25 @17.75
27	4.7650	47⅛	*17.80 @18.00	36	5.50 @5.75	5.40 @5.50	16.00 @17.50
28	4.7644	47⅛	*17.80 @18.00	35¾	5.50 @5.75	5.40 @5.50	15.75 @17.00

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

July	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
22	22 1/16	75⅜	76⅜	90½	19 27	165	162	24⅜	5.24	96	20 44
23	22⅛	74½	75⅝	89½	19.05	162½	160¼	24½	5.22	96	20 44
24	22 1/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	22⅛	71⅞	72⅛	88½	18.85	161¾	159½	24½	5.22	93½	19.91
27	22⅛	72¼	73⅛	87½	18.64	161¼	160	24⅜	5.19	92½	19 70
28	22⅛	72	73¼	87½	18.64	160½	160	24⅜	5.19	92½	19 70

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Antimony—The market has been quiet with a small business reported, and buying rather slow. Ordinary brands bring 35½@37c. per lb. Cookson's is held nominally at 48c. per lb., stocks being small.

Quicksilver—The market is strong but with less active demand than there has been. Prices show no material change. New York quotations are $92@94 per flask of 75 lb. for large lots, while $95@99 is paid for small orders. San Francisco reports by telegraph $92.50@95 per flask, on a quiet market. London price is £18 5s. per flask, with £18 2s. 6d. quoted from second hands.

Nickel is steady and unchanged at 40@50c. per lb. for ordinary forms, according to size of order. Electrolytic 3c. per lb. higher.

Minor Metals—Current sales of **Bismuth** are at $2.75@3 per lb. New York. The London price is quoted at 10s., or $2.40 per lb. there—**Cadmium** is quoted at 6s., or $1.44 per lb. in London; $1.50 per lb., New York.—**Tellurium** is reported sold at 80s., or $19.20 per lb. in London.—**Selenium** is quoted at $2@3 per lb. New York for larger quantities; $4.50@5 for retail lots.

British Imports and Exports of Metals other than iron and steel, six months ended June 30, in long tons:

	Imports		Exports	
Metals:	1914	1915	1914	1915
Copper	85,321	115,806	32,282	16,931
Tin	24,013	22,229	22,244	22,867
Lead	110,104	134,723	27,227	30,692
Zinc	65,266	52,163	5,673	1,543
Quicksilver	1,178	792	401	151
Minor metals	4,822	2,561	13,732	9,531
Ores, etc.				
Tin concentrates	19,799	25,158	.....	.....
Pyrites	419,493	493,300	.....	.....

Copper imports include metallic contents of ore, matte, etc. Exports include reëxports of foreign material.

Gold, Silver and Platinum

NEW YORK—July 28

Gold Imports in Great Britain six months ended June 30 were £6,010,211; exports, £5,530,544; excess of imports, £479,667. Comparisons with 1914 are of no use, as imports from South Africa, Australia and India have ceased, the gold produced being held in those countries subject to order, to avoid shipping risks.

Platinum shows slightly more demand with some signs of increased activity, but no material change in the market. The quotations continue about $37@39 per oz. for refined platinum and $41@44 per oz. for hard metal.

Silver—The tone of the market is without animation. London advises, if it were not for the scantiness of supplies, it would be difficult to maintain prices. At the same time a revival in demand would cause a rally in prices.

The London quotation for silver on July 16 was 22⅝d., instead of 22 5/16d. as given in our table. The error was caused by a mistake in transmission.

Silver shipments from London to the East Jan. 1 to July 14, as reported by Messrs. Pixley & Abell:

	1914	1915	Changes
India	£3,946,000	£2,800,000	D. £1,146,000
China	40,000	5,000	D. 35,000
Total	£3,986,000	£2,805,000	D. £1,181,000

Imports of Silver in Great Britain six months ended June 30 were valued at £5,725,215; exports, £4,280,369; excess of imports £1,444,846, which compares with an excess of exports of £1,452,529 in 1914. Of the imports this year £4,171,755 were from the United States.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—July 24

The base price this week was lowered to $105 per ton for 60% zinc ore. The base price paid for 80% lead ore was $60 per ton.

SHIPMENTS WEEK ENDED JULY 24

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,721,500	89,700	439,480
Year	105,762,220	4,083,160	15,201,650

Shipped during week to separating plants, 4,267,300 lb. zinc ore.

JOPLIN, MO.—July 24

Blende, high price $117.50; base per ton of 60% zinc, premium ore $115; medium $105@95, and $90 was as low as was paid for the lowest grades in carlots. Calamine base per ton of 40% zinc, $56@60 in ton and up to $80 in carlots. Average price, all grades of zinc, $107.06 per ton. Lead, high price $61.50; base, $60 per ton of 80% metal content; average, all grades of zinc, $59.59 per ton.

SHIPMENTS, WEEK ENDED JULY 24

	Blende	Calamine	Lead	Values
Totals this week.	11,266,740	715,980	1,554,990	$687,730
Totals this year.	322,177,000	27,801,370	48,763,180	13,790,670

Blende value, the week, $618,580; 30 weeks, $11,901,190.

Calamine value, the week, $22,820; 30 weeks, $600,290.

Lead value, the week, $46,330; 30 weeks, $1,289,190.

Mining operations have resumed an entirely normal stage again, and the shipment is above an average one. The two weeks of the strike gave the miners a rest and they returned to work in better spirits and with more action than had been displayed for two months.

Iron Trade Review

NEW YORK—July 28

The iron and steel markets continue to advance, though this month is usually about the dullest of the year. Domestic as well as export orders are in evidence.

A good increase is evident in structural steel, which has been rather slow. New orders are being closed and there is an evident increase in building activity.

There has been enlarged inquiry for foundry and basic pig iron, and prices generally are firmer, even showing some increase.

Imports at Baltimore for the week included 1403 tons ferromanganese from Liverpool and 9700 tons manganese ore from Brazil.

Exports from Baltimore for the past week included 12,021,292 lb. miscellaneous iron and steel products to Great Britain.

The United States Steel Corporation reports for the quarter ended June 30 that net earnings, after deducting expenses for renewals, repairs, maintenance of plants, interest on bonds and fixed charges of subsidiary companies, were as follows:

	1914	1915
April	$6,920,879	$7,286,409
May	6,845,823	9,320,576
June	6,690,894	11,343,070
Quarter	$20,457,596	$29,950,055
Depreciation, reserve fund, etc.		$6,031,013
Interest and sinking fund		7,346,478
Dividend, 1¾% on preferred stock		6,304,919
Total charges		$19,682,410
Surplus for the quarter		$8,267,645

No dividend was declared on the common stock. The increase in net earnings over the quarter ended Mar. 31 was $15,492,246, showing the great improvement in the steel trade during the past three months. For the half-year ended June 30 the net earnings amounted to $38,451,977 in 1914 and $40,407,864 in 1915, an increase of $1,955,887. The large earnings of May and June more than offset the heavy decrease in the first quarter as compared with 1914. The surplus shown was made notwithstanding an increase of $1,800,000 in the depreciation and replacement funds.

Foreign Iron Trade of Great Britain, six months ended June 30, as valued by the Board of Trade returns:

	Exports	Imports	Excess
Iron and steel	£17,771,996	£4,177,263 Exp.	£13,594,733
Machinery, hardware, etc.	14,869,771	7,140,804 Exp.	7,728,967
Totals	£32,641,767	£11,318,067 Exp.	£21,323,700
Totals, 1914	54,574,872	16,221,953 Exp.	38,352,919

Quantities of iron and steel exported, 2,376,264 tons in 1914 and 1,448,502 in 1915; imported, 1,170,989 tons in 1914 and 511,012 this year.

The British Iron Market is reported quiet, with fair production. Some current quotations for pig iron are: East Coast hematite (bessemer) pig, $24 per ton; Cleveland No. 3, $16.32. Some prices for finished iron and steel are: Steel plates, $48 per ton; steel angles, $46.80; iron ship plates, $48; iron ship angles, $52.60; iron bars, $52.80, less 2½%; steel rails, $42 per ton, net.

PITTSBURGH—July 27

The steel mills are rapidly filling up with orders. In bars the earliest delivery promise on new specifications is about six weeks, while on some sizes the time is much longer. Even plates and shapes, the demand for which has been relatively light, are not being promised earlier than Sept. 1 by the Carnegie Steel Co. In wire the demand is well above normal, in blue annealed it is quite heavy while in sheets it is

improving. Galvanized sheets have declined to 4.25c., but merely on account of the decline in spelter.

Openhearth steel has become scarce, although the full capacity is productive. Full employment of bessemer capacity depends upon whether enough buyers will be content to accept that description of steel, prospects being that they will have to lay aside their scruples.

A considerable part of the steel buying of the past fortnight has been due to buyers endeavoring to lay in stocks since they can no longer depend upon practically immediate shipments from mill and there is every reason to expect this demand to set the mills much farther behind in deliveries, so that it is universally believed the steel industry is booked for capacity operations for a period of months at least, and probably of years.

The Steel Corporation's earnings in the second quarter, announced this afternoon at $27,950,055, prove slightly larger than was expected in Pittsburgh steel circles. Earnings not far from $35,000,000 are now expected for the current quarter.

Steel bars are strong at 1.30c., with plates and shapes at 1.25c. to 1.30c. Sheets are 4.25c. for galvanized, 1.75c. to 1.80c. for black and 1.35c. to 1.40c for blue annealed

Pig Iron—The local market is quieter again, but is regarded as very firm. Sales of bessemer of 1500 tons and 450 tons respectively are reported at $14.25, Valley, an advance of 25c. over the market quoted a week ago. We now quote: Bessemer, $14.25; basic, $13; foundry and malleable, $12.75@13; gray forge, $12.50@12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—Sales of prompt continue to be made at $100@105, while the contract market is $100, Baltimore, with not much activity.

Steel—Quotations on openhearth steel are largely nominal, while bessemer quotations have not been seriously tested, the current demand being almost wholly for openhearth. We quote: Bessemer billets, $21; bessemer sheet bars, $21.50; openhearth billets, $22; openhearth sheet bars, $22.50, f.o.b. maker's mill, Youngstown, and $1 higher delivered Pittsburgh. Rods are firm and scarce at $26, Pittsburgh.

United States Foreign Trade in iron and steel and manufactures thereof is valued by the Department of Commerce as below for the five months ended May 31:

	1914	1915	Changes
Exports	$94,151,409	$107,348,938	I. $13,197,529
Imports	13,142,197	8,046,871	D. 5,095,326
Excess, exports	$81,009,212	$99,302,067	I. $18,292,855

The increase in exports this year as compared with 1914 was $4,863,080 in March and $6,802,567 in April. In the month of May the quantity of those exports which are reported by weight was 246,530 tons, against 134,605 tons in May, 1914. The larger increases were in billets, bars, sheets and wire.

FOREIGN IRON

Pig Iron Production in Germany, as reported by the German Iron & Steel Union, was 985,968 metric tons, which is 47,289 tons more than in April, and 621,243 tons less than in May, 1914. For the five months ended May 31 the total was 7,756,901 tons in 1914, and 4,540,841 tons in 1915; a decrease of 3,216,060 tons, or 41.5%, this year.

German Steel Production in April is reported by the German Iron & Steel Union at 1,012,334 metric tons, which is 85,977 tons less than in March. For the four months ended Apr. 30 the make was:

	Basic	Acid	Total
Converter ingots	2,049,639	49,650	2,099,289
Openhearth ingots	1,636,394	64,717	1,701,111
Direct castings	120,190	34,485	154,675
Crucible steel	.....	33,015	33,015
Electric steel	.....	32,498	32,498
Total	3,806,223	214,365	4,020,588
Total, 1914	5,983,589	248,740	6,232,329

The total decrease this year, as compared with 1914 was 2,211,741 tons, or 35.5%. There are 234 steel works reported in operation this year.

IRON ORE

Eastern Pennsylvania furnaces have purchased some trial lots of the off-grade Lake Superior ores which have been offered recently at attractive prices. These purchases have consisted chiefly of an old-range nonbessemer of 48% iron and 13% silicon content, which have been taken at about 7.1c. per unit of iron delivered to the furnaces, or on the basis of about $1.80 at lower lake ports.

Imports and Exports of Iron Ore in the United States, five months ended May 31, in long tons:

	1914	1915	Changes
Imports	520,398	432,766	D. 87,632
Exports	159,396	22,290	D. 137,106

Imports of manganese ore were 112,120 tons in 1914 and 27,137 in 1915; decrease, 84,983 tons.

French Imports and Exports of iron ore for two years, in metric tons:

	1913	1914	Changes
Imports	1,410,424	698,319	D. 712,105
Exports	10,066,627	4,767,194	D. 5,299,433

The heavy decreases shown were due entirely to the war, which has closed the most productive iron-ore mines and a number of furnaces.

Imports of manganese ore were 258,929 tons in 1913, and 153,449 in 1914; decrease, 105,480 tons.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 371,144 short tons; shipments, 365,615 tons. Production in the Greensburg and upper Connellsville districts was 42,067 tons.

Connellsville—The prompt furnace coke market has been unable to stand the recent increase in production, coupled with orders from five consumers to curtail shipments on contracts temporarily, and the market has broken from $1.70 to $1.60, with no takers at the lower price. There are no negotiations of importance for contract coke. We quote: Prompt furnace, $1.60; contracts over third quarter, $1.75; contracts over second half, $1.85@2; prompt foundry, $2.10@2.40; contract foundry, $2.25@2.60, per net ton at ovens.

Coal and Coke Tonnage, Pennsylvania R.R. lines east of Pittsburgh and Erie, six months ended June 30, in short tons:

	1914	1915	Changes
Anthracite	5,560,680	5,423,467	D. 137,213
Bituminous	21,973,572	20,261,777	D. 1,711,795
Coke	5,196,084	4,998,919	D. 197,165
Totals	32,730,336	30,684,163	D. 2,046,173

The total tonnage for the month of June this year was 5,498,232, an increase of 181,576 tons over June, 1914; the gain being chiefly in coke.

Foreign Fuel Trade of the United States, five months ended May 31, as reported by the Department of Commerce, in long tons:

	Exports		Imports	
	1914	1915	1914	191
Anthracite	1,439,402	1,371,955	4,291	222
Bituminous	4,564,531	4,427,832	567,173	604,337
Coke	305,611	292,151	38,387	14,900
Bunker coal	3,157,120	2,913,277	.....	.....
Totals	9,466,664	9,005,215	609,851	619,459

The bunker coal, or coal furnished to steamers in foreign trade, is practically all bituminous. Exports of bituminous coal in May increased 320,464 tons, chiefly in shipments to Brazil and Argentine.

Chemicals

NEW YORK—July 28

The general market is quiet; indeed no great activity is to be expected at this season, when midsummer dullness is the rule.

Arsenic—Very little is doing in this article. The market is dull, but not especially weak. Prices are unchanged at about $4 per 100 lb. for both spot and futures.

Copper Sulphate—There is nothing new. On a quiet market prices are steady. The current quotations are $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is fair for the season, and is steady, with prices unchanged. Quotations are 2.35c. per lb. for spot and for all positions this year.

Pyrites—Imports at Baltimore for the week included 4584 tons pyrites from Huelva, Spain.

NEW CALEDONIA

Exports of minerals from New Caledonia for four years past have been as follows, in metric tons:

Ores:	1911	1912	1913	1914
Nickel	120,059	74,312	93,190	94,154
Cobalt	.....	.....	.....	920
Chrome	32,806	51,516	63,370	71,471
Mattes:				
Nickel	2,993	5,098	5,893	5,287
Cobalt	.....	.....	.....	25

In 1914 the exports included 305 tons nickel matte and 25,102 tons chrome ore to the United States direct

Assessments

Company	Delinqe	Sale	Amt.
American, Ida	Aug. 7	Sept. 2	$0.001
Blue Bell, Ida	July 5	Aug. 4	0.003
Challenge Con., Nev	July 12	Aug. 4	0.05
Con. Virginia, Nev	July 19	Aug. 10	0.05
Contact Copper, Mich	May 15	.....	0.50
East Hercules, Wash	Aug. 10	Sept. 10	0.0015
Eastern Star, Ida	.....	Aug. 24	0.002
Four Timbers, Ida	July 28	Aug. 28	0.001
Hancock Cons., Mich	Sept. 1	.....	1.00
Hancock Cons., Mich	Jan. 3	.....	1.00
Houghton, Mich	May 25	.....	1.00
Idaho-Nevada, Ida	July 14	Aug. 6	0.001
Iron Mask, Ida	July 1	Aug. 10	0.002
Ivanhoe, Ida	July 12	Aug. 12	0.002
Majestic-Idol, Nev	Dec. 15	July 20	0.005
Mayflower, Ida	June 15	July 17	0.005
Michigan Copper, Mich	July 19	.....	1.00
Mineral Range, Utah	May 24	.....	0.003
Monarch Pitts., Nev	June 14	July 14	0.01
Moonlight, Ida	June 5	July 8	0.005
Nabob, Ida	July 5	Aug. 2	0.005
New Arcadian, Mich	June 1	.....	0.50
New Arcadian, Mich	Dec. 1	.....	0.50
New Baltic, Mich	July 15	.....	0.50
New Baltic, Mich	Jan. 15	.....	0.50
New Yerrington Cop., Nev	July 9	July 27	0.01
Nevada Douglas, Nev	July 21	Aug. 18	0.10
North Bunker Hill, Ida	June 12	July 17	0.002
Old Veteran, Ida	July 5	July 31	0.002
Oreano, Ida	Aug. 2	Sept. 2	0.0015
Rainbow, Ida	July 7	Aug. 7	0.002
Rescue-Eula, Nev	July 14	Aug. 19	0.01
Revelator, Utah	Aug. 17	Sept. 3	0.00½
Revelator, Utah	Oct. 4	Oct. 25	0.00½
Rhode Island, Ida	June 24	July 24	0.001
Sierra Nevada, Nev	July 27	Aug. 16	0.05
Sonora, Ida	July 23	Aug. 31	0.004
Springfield, Ida	July 30	Aug. 30	0.002
Sunrise, Ida	July 17	Aug. 17	0.002
Sunset Dev., Ida	June 30	July 24	0.0025
Tarbox, Ida	July 17	Aug. 7	0.0025
Tonopah Gypsy Queen, Nev	July 12	Aug. 17	0.00½
Umatilla Tonopah, Nev	July 12	Aug. 16	0.01
Virginia, Ida., (post.)	.....	July 29	0.02
West Tonopah Con., Nev	July 10	Aug. 10	0.01
Wyandot, Mich	July 28	.....	1.00

Stock Quotations

Among sales at auction during the week were: New Mexico-Colorado Coal & Mining Co. 2½ com. trust certs., $4 lot; same company, $750 Series A income bonds, 1941, $12 lot.

COLO. SPRINGS July 27		SALT LAKE July 27	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.03	Beck Tunnel	.03
Cripple Cr'k Con	.0095	Black Jack	.10½
C. K. & N	‡.03	Colorado Mining	.08½
Doctor Jack Pot	.10	Crown Point	.01½
Elkton Con	.33	Daly-Judge	7.50
El Paso	.90	Gold Chain	.20
Findlay	.04	Grand Central	.60
Gold Dollar	.01	Iron Blossom	.71
Gold Sovereign	.03½	Little Bell	.10
Golden Cycle	1.78	Lower Mammoth	.03
Isabella	.15½	Mason Valley	2.00
Jack Pot	.07	May Day	.21
Jennie Sample	‡.02	Opohongo	.00½
Jerry Johnson	.05½	Prince Con	.75
Lexington	.004	Seven Troughs	.01½
Mary McKinney	.37½	Silver King Coal'n	3.52½
Pharmacist	‡.005	Silver King Con	2.00
Portland	1.43	Sioux Con	.02½
Raven B. H	.02	Uncle Sam	.03½
Vindicator	1.75	Yankee	.08

TORONTO July 27			
Bailey	‡.02	Dome Exten	.18
Coniagas	4.00	Foley O'Brien	.28
Peterson Lake	.21	Hollinger	25.00
Right of Way	.03	Imperial	.06
Seneca Superior	‡.90	Jupiter	.10
Silver Queen	‡.01	McIntyre	.48
T. & Hudson Bay	18.00	Pearl Lake	.01
Timiskaming	.34	Porcu. Crown	.90
Wettlaufer-Lor	.02	Preston E. D.	.03
Dome Mines	23.75	Rea	‡.10

SAN FRANCISCO July 27			
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.07	Belmont	3.55
Andes	.07	Jim Butler	.83
Belcher	.25	Lone Star	.04
Best & Belcher	.06	MacNamara	.01
Caledonia	.20	Midway	.10
Challenge Con	.07	Mont.-Tonopah	.35
Confidence	.10	North Star	.12
Con. Virginia	.10	Rescue Eula	.07
Gould & Curry	.03	West End Con	.65
Hale & Norcross	.04	Atlanta	.30
Julia	.01	Booth	.49
Mexican	.42	C.O.D. Con	.03
Occidental	.79	Comb. Frac	.08
Ophir	.16	Jumbo Extension	1.52½
Overman	.07	Pitts.-Silver Peak	.10
Potosi	.02	Round Mountain	.45
Savage	.03	Sandstorm Kendall	.07
Sierra Nevada	.09	Silver Pick	.09½
Union Con	.14	Central Eureka	.16
Yellow Jacket	.30	So. Eureka	‡1.50

N. Y. EXCH. July 27	
Name of Comp.	Clg.
Amalgamated	71½
Am.Sm.&Ref.,com	77⅞
Am. Sm. & Ref., pf.	106½
Am. Sm. Sec., pf. B	80
Anaconda	66½
Batopilas Min	1½
Bethlehem Steel	247
Bethlehem Steel, pf.	140½
Chino	44
Colo. Fuel & Iron	36
Federal M. & S., pf.	46
Great Nor., ore., ctf.	37½
Guggen. Exp	59½
Homestake	117½
Inspiration Con	29⅝
Mex. Petroleum	73½
Miami Copper	26½
Nat'l Lead, com	62
National Lead, pf	108½
Nev. Consol	14
Ontario Min	2½
Quicksilver, pf	4
Ray Con	22½
Republic I&S, com	37
Republic I&S, pf	93⅜
SlossSheff'd, com	39
Tennessee Copper	36½
Utah Copper	64
U. S. Steel, com	65½
U. S. Steel, pf	111⅛

N. Y. CURB July 27	
Name of Comp.	Clg.
Alaska Juneau	11⅛
Alta Con	.82
Beaver Con	.30
Big Four	.05
Blue Bell	‡.02
Braden Copper	6½
Buffalo Mines	⅛
Can. Cop. Corpn	13/16
Can. G. & S	‡.05
Cashboy	‡.05½
Chambers Ferland	.14
Chile Cop	18⅛
Con. Ariz. Sm	⅛
Con. Coppermines	‡2½
Con. Nev.-Utah	5/16
Davis-Daly	1 1/16
Diam'field-Daisy	.04
Dia. Black B	.03
Florence	.50
Goldfield Con	1 5/16
Goldfield Merger	.21⅛
Greene Cananea	40½
Kennecott Cop	32½
Kerr Lake	4
La Rose	7/16
McKinley-Dar-Sa	.20
Majestic	.70
Mines of Am	2½
Nevada Hills	.17
New Utah Bingham	3½
Nipissing Mines	5⅛
Ohio Copper	.21
Oro	.08
St. Joseph Lead	12⅛
South Utah	‡.25
Stand'd Oil of N.J.	400
Standard S. L	1 9/16
Stewart	1⅞
Tonopah	5½
Tonopah Ex	2 9/16
Tonopah Merger	.23
Tribullion	⅛
Tularosa	‡ 1/16
Yukon Gold	2⅛

LONDON July 13			
Alaska Tre'dwell	£7	7s	6d
Cam & Motor	0	14	0
Camp Bird	0	4	6
El Oro	0	7	3
Esperanza	0	8	0
Mexico Mines	3	7	6
Oroville	0	14	6
Santa Gert'dis	0	7	6
Tomboy	1	1	3
Tough Oakes	0	5	6

BOSTON EXCH July 27	
Name of Comp.	Clg.
Adventure	2
Ahmeek	395
Alaska Gold M	33
Algomah	2
Allouez	51½
Am. Zinc	55
Ariz. Com., ctfs	7
Bonanza	.35
Butte-Balaklava	3½
Butte & Superior	69½
Calumet & Ariz	62½
Calumet & Hecla	551
Centennial	17
Cliff	1
Copper Range	52½
Daly West	2½
East Butte	12⅛
Franklin	8½
Granby	81
Hancock	16½
Hedley	28½
Helvetia	.35
Indiana	3⅞
Island Cr'k, com	47⅞
Island Cr'k, pfd	89
Isle Royale	26½
Keweenaw	1½
Lake	13½
La Salle	6½
Mass	11½
Mayflower	4
Michigan	2½
Mohawk	69
New Arcadian	9⅞
North Butte	29⅛
North Lake	1½
Ojibway	2½
Old Colony	3½
Old Dominion	52
Osceola	75
Quincy	80
Santa Fe	2⅜
Shannon	7½
Shattuck-Ariz	25½
Superior	25⅜
Superior & Bost	2½
Tamarack	40½
Trinity	4
Tuolumne	.45
U. S. Smelting	39½
U. S. Smelt'g, pf	46½
Utah Apex	3⅛
Utah Con	11⅛
Victoria	2½
Winona	3⅞
Wolverine	59
Wyandot	.65

BOSTON CURB July 27	
Name of Comp.	Bid.
Alvarado	.70
Bingham Mines	8½
Boston Ely	.29
Butte & Lon'n Dev	.22
Calaveras	1⅜
Calumet-Corbin	.04
Chief Con	.85
Corbin	‡.50
Cortez	.40
Crown Reserve	.45
Eagle & Blue Bell	1⅜
First Nat. Cop	2½
Houghton Copper	3½
Iron Cap Cop., pf	5½
Majestic	.70
Mexican Metals	.20
Nevada-Douglas	.70
New Baltic	3
Oneco	1
Raven Copper	.11
Smokey Dev	.15
So. Lake	‡6½
Tonopah Victor	.28
Trethewey	.11
United Verde Ext	5½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.499	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	.....	27.074	25.219	.....
August	59.293	54.344	.....	27.335	25.979	.....
September	60.640	53.290	.....	27.986	24.260	.....
October	60.793	50.654	.....	28.083	23.199	.....
November	58.995	49.082	.....	27.263	22.703	.....
December	57.760	49.375	.....	26.720	22.900	.....
Year	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.49	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.99	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	.....	60.540	.....	64.955	.....
August	*	.....	‡	.....	‡	.....
September	*	.....	‡	.....	‡	.....
October	*	.....	‡	.....	‡	.....
November	11.739	.....	53.227	.....	*	.....
December	12.801	.....	56.841	.....	*	.....
Year	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	.....	142.517	.....
August	*	.....	‡	.....
September	32.675	.....	‡	.....
October	30.284	.....	‡	.....
November	33.304	.....	149.391	.....
December	33.601	.....	147.102	.....
Av. year	34.301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	.....	3.738	.....	19.051	.....
August	3.875	.....	3.715	.....	‡	.....
September	3.828	.....	3.658	.....	‡	.....
October	3.528	.....	3.384	.....	‡	.....
November	3.683	.....	3.585	.....	18.500	.....
December	3.800	.....	3.662	.....	19.097	.....
Year	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.967	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	.....	4.770	.....	21.568	.....
August	5.568	.....	5.418	.....	‡	.....
September	5.380	.....	5.230	.....	‡	.....
October	4.909	.....	4.750	.....	‡	.....
November	5.112	.....	4.962	.....	25.016	.....
December	5.592	.....	5.430	.....	27.369	.....
Year	5.213	.....	5.061	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.91	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	.....	13.90	.....	13.90	.....
August	14.90	.....	13.90	.....	14.08	.....
September	14.90	.....	13.90	.....	14.03	.....
October	14.84	.....	13.75	.....	13.97	.....
November	14.59	.....	13.43	.....	13.83	.....
December	14.70	.....	13.45	.....	13.83	.....
Year	$14.88	.....	$13.78	.....	$14.01	.....